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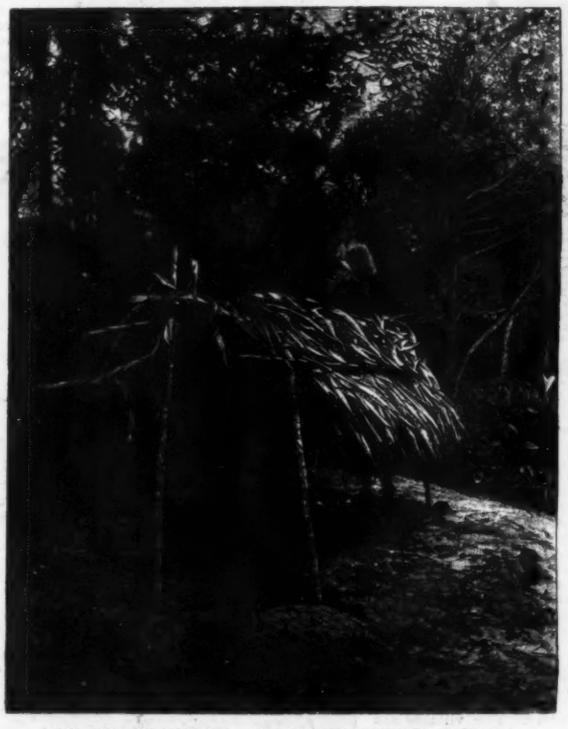
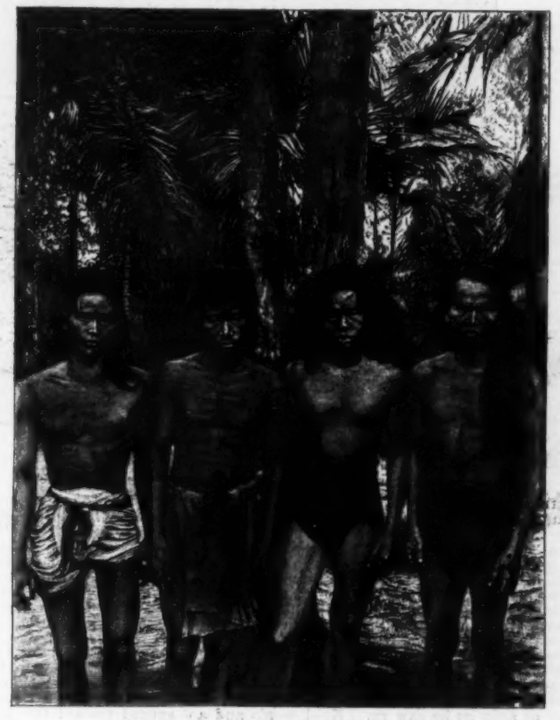
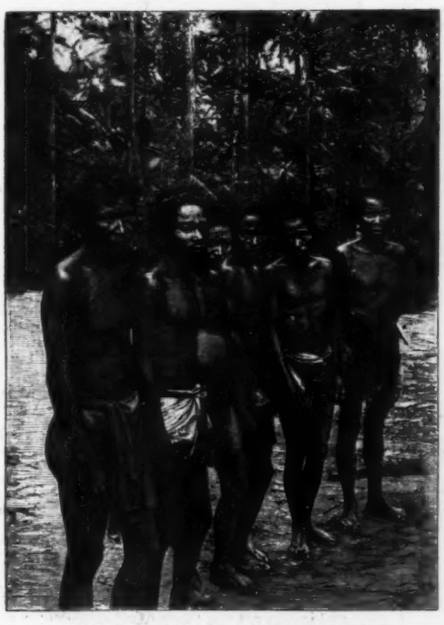


AN ORANG-MAMMA GRAVE IN SUNGEI RAJAH



ORANG-MAMMAS OF SUNGEI RAJAH.



SUNGEI RAJAH ORANG-MAMMAS

THE RULER OF ALL ORANG-MAMMAS, WITH THE MAGIC DRUM.

THE ORANG-MAMMAS.--AN UNKNOWN SUMATRAN TRIBE.

THE ORANG-MAMMAS.—AN UNKNOWN SUMATRAN TRIBE.*

By Gustav Schneider.

From 1897 to 1899, I traveled along the eastern coast of Sumatra, to study the fauna of the island. For some time I lived in Dschapura, Indragiri, and made several long journeys into the interior of the province. Indragiri, although a tenure of the Sultan of Lingga, forms part of the residency of Riou, which has an area of 13,804 square miles. Its inhabitants are Mohammedan Malays. In Batu Ridial, I first heard of a heathen tribe, Orang-Mamma, living in the primeval forests on the right bank of the Quantan River. I was told that the journey into the land of this unknown people was both painful and dangerous. I could engage no guides or carriers. Through the influence of Sultan Muda, of Pranap, who strongly advised me not to take so perilous a journey, I finally secured the services of the village chief of Kloyan and eight of his men. My two Malay servants also formed part of my escort.

After hard marches through hilly country and dense jungle, we reached the first Mamma settlement in February, 1899. Brigi, as the place is called, consists of three houses, distant about 1¼ miles from one another. In the first of these houses we met a man who showed great fear as soon as he saw us. Kind words and a few presents reassured him, and I learned that he was a chieftain. Upon my request to see the other inhabitants of the house, he called out five men and a boy. Additional presents induced them all to stand before my camera. Two of them even offered to guide me to the next settlement, for my guides had declared that, unfamiliar as they were with the country, they could not conduct me further. There were no roads; we could follow only the paths made before us by elephants. After a five hours' tramp through marshy jungle, we reached the next settlement, Glugor, consisting of two houses. Not far from the first of these houses I saw many men working in the open. As soon as they spied us they cried out in fear and fled into the forest. Three men, who came out of the house, also attempted to run away, but were calmed by our guides. Finally, several of those who had concealed themselves in the jungle were induced to return. After having distributed presents in considerable quantities we were allowed to pass the night in the house. Before we proceeded on our journey on the following morning, I distributed more presents, in order to obtain photographs. When I shot at a rhinoceros-bird, men, women and children fell to the ground, and trembled with fear. The two men from Brigi returned to their homes, but I managed to engage new guides. After a painful march of eight hours through marsh and jungle, we arrived at Sungei Dunu, called also Dato Bate and Sinkop, the residence of the ruler of all Mammas.

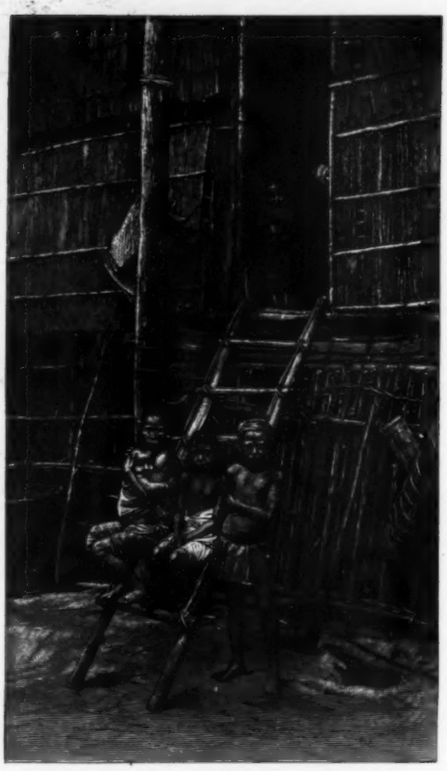
I visited nearly every one of the twelve Mamma settlements. Those which should be particularly mentioned are Passio Pongal, Sungei Liman, Sungei Sala, Sungei Rajah. All are located in the virgin forest and extend toward the Djinako River. The villages are four to eight hours, and sometimes whole days distant from one another. The number of Mammas is about 400 to 500. Their houses are similar to those of the neighboring Malays, and are built on piles. I asked the Mammas why they erected their dwellings on piles. They told me that they did so merely to protect themselves from the elephant, rhinoceros, and tiger. The Malays give similar reasons for building pile huts. The chieftains' houses are more substantially built, and are larger than those of ordinary Mammas. They are about 25 feet wide and 35 feet deep; in the back of each is a shed built of bark or woven twigs and branches. The Mammas, physically considered, are an admirable tribe. They have long, black, coarse hair falling straight to the shoulders, or coiled upon the head and covered with a cotton head-cloth. In color they are yellow, brown, or dark brown. The nose is flat, with large nostrils. The eyes are dark brown. When the age of puberty has been reached, the upper incisors are ground off to the flesh, and the fangs, together with the remaining teeth, are stained black with the juice of a variety of fig. Fully grown men are about 5½ feet tall; the women are much smaller. I had the opportunity of measuring only one woman, one of the tallest I saw; she measured 4·85 feet. With the exception of a breech-cloth, men, women and children wear no clothing. This breech-cloth consists of beaten bast, a hand's breadth in width, and two yards in length. Cotton (obtained by barter) is sometimes used. During rainy weather and during sleep, pieces of beaten bast are hung about the dwelling or wrapped around the body. I saw men with bracelets and rings of tridacna shells and a few with similar ornaments of glass beads. Undoubtedly these rings and bracelets were obtained by barter from the Malays, who also supply the iron used for weapons, knives and cooking-utensils. To be sure there are blacksmiths among the Mammas; but they are not so skilful in making sharp, cutting instruments as the Malays. Spears, javelins and lances are provided with shafts of rattan, bent into the proper shape by peculiar vises. As a weapon of defense the lance is used. For hunting, the spear is employed; and for fish-spearing, the javelin. Knife-handles are made of ivory, horn and wood, often beautifully carved. The chieftain of Sungie Dunu presented me with a most interesting knife. It had been used by his dead wife for cutting rice. Owing to its shape, as well as its ornamentation, it is particularly noteworthy. He assured me that there was not another knife of the kind among all the Mammas. To receive gifts was indeed rare; for the people have little and are not generous. The Mammas also make good baskets and the like, of split, stained rattan. Weaving and the making of pots are unknown arts. Vessels are made of gourds and sometimes of other fruit. With the exception of a primitive flute, the Mammas have no musical instrument. The chief occupations are hunting, fishing and rice growing. Dammar-gum, rubber, honey, beeswax, rattan and fruits are gathered and are either used by the Mammas themselves or exchanged for Malay salt and cotton. Rice, fowl game, fish and fruit serve as food. Hens, dogs, cats (with twisted tail), and a few goats are reared.

The language of the Mammas, although a Malay dialect, can hardly be understood even by the Malays. Writing is unknown.

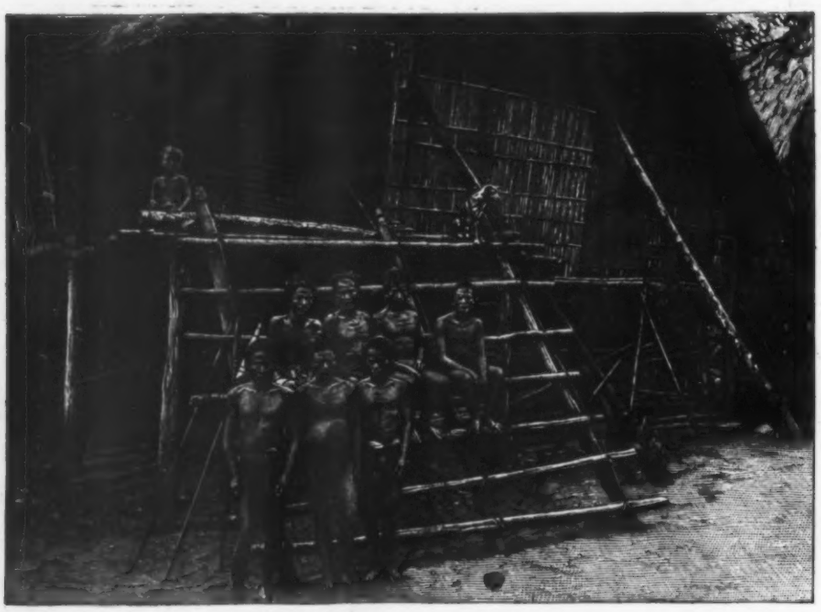
The dead are buried near the houses, about 5 feet below the surface of the ground. The body rests upon split bamboo and a piece of bast two yards long. The grave is covered with a primitive roofing of drooping, fimbriate leaves, which are supposed to serve the purpose of warding off evil spirits. A small basket of pisang fruit and the gourd used by the dead man are laid on the grave. The Mammas are heathen and believe in a good spirit and in several evil spirits. The evil spirits are the cause of all misfortune, and the aid of the good spirit must be invoked against them by a wizard or magician who is his representative among men. The good spirit dwells in a peculiar drum, made of a hollow tree-trunk, the upper end of which is covered by a goatskin. The drum is presided over by a wizard, but the main portion (considered the most ef-

* Translated from Illustrirte Zeitung.

CLEANING RICE IN SUNGEI RAJAH.



MAMMA WOMAN AND CHILDREN—SUNGEI RAJAH.



ORANG-MAMMAS OF SUNGEI RAJAH.

fective) is kept in the house of the ruling chieftain, at the Dato Bate, in Sungei Dunu, and is lashed in place and closely guarded. The Mammas believe that with the loss of this drum, their entire race would be destroyed. In case of severe illness the spirit is drummed out, so that he may ride along the Lantjang in a special boat, which is hung up, and procure the healing medicine. The returning spirit is supposed to bring their medicine in a suspended fan of the pinang-palm, called "hand of the spirit." The sick man is supposed to recover after having been touched three times with the fan, provided he has not angered the spirit. The Mammas suffer considerably from scabies; I saw some even pock-marked men among them. Fever and dysentery are also met with. The sick are carried out into the sun and laid upon a specially constructed frame.

Girls are not sold, as in most of the East Indies; for if a youth desires to marry, he has merely to gain the consent of her who has found favor in his eyes. The marriage ceremony is performed by the chieftain. The bridegroom asks the chieftain for the Djang Glangong, a peculiarly carved black

ORANG-MAMMA HOUSE IN SUNGEI SALA.

stake, which is thrust into the earth beneath a durian tree and provided at its top with a bamboo twig decorated with streamers. A black cock and hen are then tied to the foot of the stake. As soon as the sun has reached the zenith, the bridal couple and all the other persons leave the house and walk to the stake. The cock is cut loose and given to the chieftain. Bridegroom and bride sit upon the ground, face to face, their feet touching each other. The chieftain kills the cock and the hen over the legs of the bridal couple. The ceremony is then ended. The couple wash the blood away and reenter the house, the bridegroom by way of the front entrance, the bride by way of the rear. After a few hours, the guests assemble for the wedding feast.

Polygamy is unknown among the Mammas. A man can marry but one woman, and she remains his wife until death.

It is difficult to determine whether the Mammas are the remnants of a primitive Sumatran people, or only a branch of the present race. At all events, they differ in many respects from the people who now inhabit the island.

BABYLONIAN SEALS.

ONE of the very oldest seats of Oriental civilization, long since extinct, was Babylonia. There prevailed among the Babylonians, says W. G. Bowdoin, in The New York Times, much more scientific knowledge than we are perhaps accustomed to think. The sun dial was certainly known and the clepsydra, or water clock; the lever and pulley as well as many other forms that indicate a high appreciation of knowledge, learning and discovery. Literature flourished and libraries abounded.

The cylinder originated in Babylonia. In origin the cylinder, though less simple than the flat seal, undoubtedly has a greater antiquity. It may, indeed, safely be stated that the oldest known form of seal is a cylinder. The universal reed, indigenous to the country of origin, furnished the model upon which this form of seal was based, and it is more than probable that reed sections were thus primitively used. The step between cutting one's own private mark upon a section of reed and of replacing such a material with an engraved and axis-pierced stone cylinder was a short one.

It is quite natural to suppose that the perishable reed furnished the shape and design for the permanent stone seal which succeeded and to which we owe a great deal in a literary and artistic sense for the preservation of much that, had the medium used been the papyrus leaves, would have in many instances long ago been lost forever.

These archaic seals were worn by their ancient owners round the neck, on the finger, on the wrist, or fastened to the garment They were at once amulets against sickness and witchcraft and seals with which impressions were made at the end of public or private documents. Such seals usually contained the name of the owner and of the divinity under whose particular protection he had probably placed himself. Herodotus states that the Babylonians were accustomed to have their signets constantly with them as a modern Eastern now always carries his modern seal.

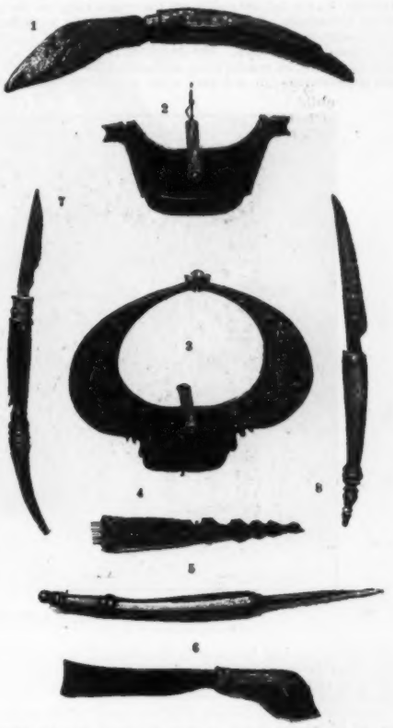
These antique cylinders, cut in intaglio, have been found in considerable quantity, and the British Museum has now, perhaps, the best collection of the most interesting relics of an age and a people long since forgotten.

Next in value to the collections of the British Museum and of M. de Clercq, of Paris, comes that of the New York Metropolitan Museum of Art, whose collection is numerically stronger than any other collection, public or private, and now numbers over 750 specimens. The Bibliothèque Nationale and the Louvre, in Paris, both have over 200 examples, while a number of other collections, including some private ones, contain from 50 to 100 or more.

No absolute uniformity of size appears in these cylinders. According to Layard, whose observations are confirmed by museum examples, they vary from the diameter of a lead pencil to something over that of a man's thumb, and range from about a quarter of an inch to two inches in length. In the cases of some important seals the engravers introduced at times a concavity or convexity along the line of length, but as a rule the plain cylinders are in the majority. The ordinary material used was hematite, and the small common Babylonian seals of the ordinary people are always found in this form.

This mineral has a grain most excellent for sharp cutting, a hardness varying from 5·5 to 6·5 in the scale, and a good color, frequently black, which affords a better contrast for the engraving than most mediums. The very oldest seals are not cut on hematite, usually shell or black serpentine having been used in preference, but they have, nevertheless, a considerable mythological value, and the cutting on hematite is for the most part excellent.

Lapis lazuli, whose hardness is about the same as



1. Knife for paring rattan. 2. Knife for cutting rice. 3. Peculiar rice-cutting knife of chieftain's wife. 4. Knife for cutting leaves used in basket-weaving. 5. Perforating instrument. 6. Kitchen knife. 7. Buckhorn-handled knife. 8. Knife for general use.

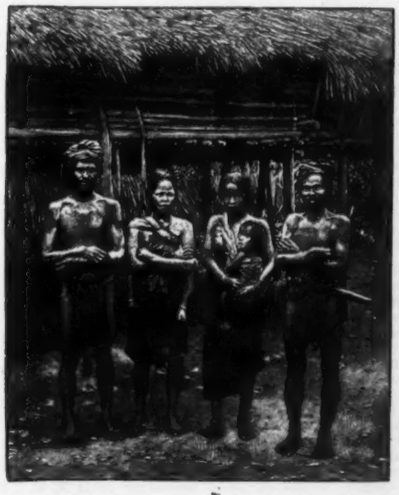
MAMMA KNIVES.

that of hematite, was an early favorite because of its brilliant coloring, and a large number of the so-called royal cylinders are in lapis lazuli. Other stones that obtained more or less favor were quartz, chalcedony, sapphirine (a pale blue chalcedony), carnelean, banded agate, jasper, amethyst, alabaster, black dolerite, marble, onyx, serpentine, syenite and porphyry.

Some of the best authorities have concluded that the engravers of these cylinders must have used the diamond in their work. The admirable freehand engraving of the earliest cylinders that have come down to us certainly suggests the use of the diamond, but this would imply trade with India, not easy to believe. There is, moreover, no reason why most, if not all, of the minerals used could not have been successfully cut with flakes or fragments of emery or corundum, which was abundant, and, according to Wilkinson, was extensively used in Egypt for the cutting and polishing of native granites.

One cylinder found in a mound in the desert near Sinjar still retained its copper setting. They revolved upon a metal axis like a garden rolling stone. The signet cylinder of Sennacherib himself was afterward discovered at the foot of the great bulls forming an entrance to his palace, and is now in the British Museum. It is engraved with wonderful minuteness

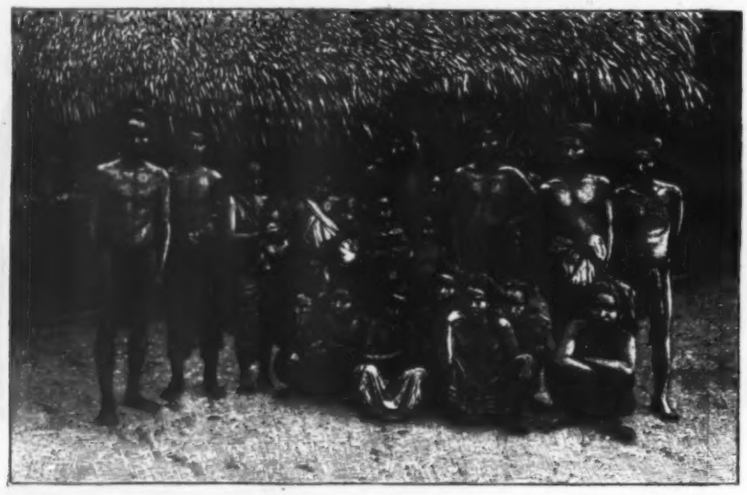
GATHERING BEESWAX IN SUNGEI SALA.



ORANG-MAMMA FAMILY OF PASSIO PONGAL.

and delicacy on a cylinder of translucent green feldspar, otherwise Amazon stone. The king stands in front of the sacred tree, bearing acorns instead of flowers. Above is the winged emblem of Ashur, here represented as a triad with three heads, and which is altogether a very remarkable and interesting mode of portraying the supreme deity.

The earliest specimens of Chaldean art that have been preserved to us are characterized by a rudeness and a crudity that were singularly free from the conventionality that afterward so marked and influenced them. Izdubar, the great Babylonian king, who has been identified by George Smith of the British Museum as the Biblical nimrod, and some of his legendary exploits, was a favorite subject for engraving on Babylonian cylinders. In his hands furious lions were only playthings, to be handled and conquered as a little child handles its toys. He frequently recurs in a variety of attire, in conformity with the epoch of production represented, in conflict with a rampant lion, the same design being frequently duplicated, but whether such duplication is to be interpreted as indicating poverty of invention or a desire for emphasis is as yet only speculative.



ORANG-MAMMAS OF GLUGOR.

Another favorite representative type of Izdubar is that in which he appears in conflict with the human-headed bull of Anu, which is derived from the oldest existing epic of which we have any knowledge. The mythology is very curious and most dramatic. The daughter of Anu (king of angels and spirits), the goddess Ishtar, sought the love of Izdubar and an alliance with him, but was ungallantly rejected by him. In revenge for this slight and to punish him she appealed to her father, Anu, who in response to her importunities, created a gigantic bull, but Izdubar overcame and slew the monster in single combat, and it is this glorious victory of Izdubar over and the mutilation of the carcass of the monstrous bull that finds such frequent expressions not alone in the Babylonian cylinder seals and in the poem whence it is derived, but also in the constellation Taurus, which has a Babylonian origin.

Sometimes Izdubar is pictured on a cylinder in company with his friend Heabani, who appears as having the body of a bull but the head and arms of a man, altogether superior to the well-known Greek Satyr and entirely wanting in legend the pernicious character of the Satyr. Cylinders having an antiquity from 2,000 to about 4,000 B. C. frequently portray the two on one seal, one fighting a lion, the other a bull.

Some of the other exploits of Izdubar, not all of which find a place on cylinders, consisted in delivering his country from foreign dominion and in staying the usurper. He then extended his kingdom into Assyria, which he colonized, and subsequently founded Nineveh.

For us, however, the most interesting groups that appear on some of the cylinders must ever be those which are similar to or which suggest familiar Biblical incidents. The Genesis stories of the creation, of the fall of man, the flood, and others, all have their counterpart in the traditions of the Euphrates. The identification of parallelism, while not absolute, is yet so close that it is easy for the imagination to bridge the space that lies between the one and the other. The British Museum has a striking and important specimen of a Babylonian cylinder which has been singled out as the object of much discussion. It shows two figures seated, one on either side of a tree, toward the fruit of which each extends one hand, while at the back of the left-hand (female) figure an upright serpent stands with his head turned toward the woman and which Mr. Smith in his volume on the "Caldean Account of Genesis" considers as a most probable form of the Biblical story of the fall that was thus so evidently currently known and accepted in the earliest times in Babylonia.

Engravings thought by Mr. Smith to be representations of the building of the Tower of Babel are also met with on Babylonian cylinders. "Bel, Lord of the World, Father of the Gods, Creator," is frequently represented in conflict with the dragon which strikingly resembles the heraldic griffins, more recently familiar to us. Sir Henry Rawlinson has called attention to many coincidences between the geography of Babylonia and the account of the Garden of Eden in Genesis, and has suggested the great probability of the records in that portion of the Scriptures having had a Babylonian origin.

There are some hundreds of these seals in European and other museums, the earlier among which include many specimens carved with scenes from the Genesis legends. Some of these are older than B. C. 2,000. The cylinder was quite as ancient and characteristic of Babylon as the scarab was of Egypt. The Babylonian seals, cylindrical in shape, flourished and had a life of some 4,000 consecutive years before they gave way before the slow process of reformation to the cone and later to the ring forms, which, with some conventional modifications, are now used. One may well marvel at the pertinacity with which men clung to the primitive long after the substitution of something better was possible. Had it been otherwise, however, we had lost the contact we now have with manners, customs, myths and beliefs long gone by that are most interesting and curious.

ANIMAL SCAVENGERS.

THE Fauna, living creatures, which play the rôle of scavenger in Nature, and thus form a portion of her Corps de Santé, are as numerous as they are interesting. Indefatigable policers of the public domain, they have little in common, save their beneficent rôle and the devouring appetite which urges them to the same. As individuals, generally, they lack both prestige and charm, and their sole merit is the tremendous part they play in the hygiene of Nature.

Let us take the jackal, for instance, that Bohemian of the desert, whose vast domain embraces Persia, Arabia, Babylonia, Syria, Egypt, a part of Asia Minor and the whole North African coast, whose nightly lamentations may be heard anywhere from the Gulf of Persia to the Strait of Gibraltar. He swarms in Abyssinia and in the Sahara, and travels, like one possessed, from Barbary to the Cape of Good Hope. Were it not for the cold, his howling race would overrun the globe.

Naturalists tell us that driven by hunger he will sometimes even attack man, but this is assuredly most rare. Living, as he does, on animal offal, he is less an assassin than thief, less a slayer than a glutton on putrid meat. More prompt at flight than in attack, he shrieks rather to encourage himself than to intimidate the world, with the strange and uncouth sounds with which he burthens the night winds.

Like the hyena, his filthy companion, the jackal is a most valuable agent of public salubrity, a most important functionary of what we might call the African "commission of public highways" (voirie).

While a mighty swallower of carrion and indefatigable picker of putrid carcasses, the jackal is, however, by no means averse to a bit of fresh meat occasionlly. He is, in fact, the legendary "purveyor for the lion," and in this way: He, or they, for they rarely "work this trick" alone, first arouse the quarry by their peculiar and distressing howlings or screechings (or both, for the cry of the jackal is neither the one nor the other, and yet a mixture of both—a "voix lamentable," as described by a French author). The monarch, thoroughly advised as to what the racket is about, quits his lair and presents himself to the view of his beaters. His bearing and mien is anything but satisfactory to them. He admonishes them to be gone, and not again to disturb his rest, and they heed the admonition. Silence reigns where but a moment before the noise resembled pandemonium let loose, and the jackals slink into outer darkness. Then Leo turns his attention to the game, and soon brings it low—and eats all of it, or all that he wants. "Ego nominor Leo" is his motto, and the jackals have the bones, bare, possibly, but still smelling of fresh meat.

He is a strange brute, the jackal, as anybody who has ever passed a "first night" in Africa can tell. All is silent, the sky full of palpitant stars, and the weary traveler is composing himself to his first sweet sleep in the desert, when suddenly then comes from beyond the scope of the firelight a mournful, despairing cry. It scarcely ceases before it is echoed from a thousand throats, in hideous intensity—a commingling of noises unlike anything else in Nature, piercing the ear-drums, mournful beyond description, and at the same blood-curdling. It vibrates amid the rocks, undulates over the sand, and fills the void immense—a "De profundis" of the desert. The vultures, visible all the day, have gone to rest, and the jackals have taken their place. The scavengers have come from their caverns in the rocks, their burrows in the earth, from here, there and everywhere, to commence their night service in the interests of hygiene, and to relieve the "day turn" of the vultures.

To appreciate the work done by these scavengers let us take a glance at a typical African village at nightfall, and the same by early morning light. The European traveler, approaching such a village for the first time, and viewing it from afar, is charmed and delighted at the scene—the little huts lying in shadow beneath the huge forest trees, look cool and inviting, and seem to promise the tired traveler a comfortable night's rest. Approach, however, quickly disenchants. The straggling areas between the huts, called, for want of a more appropriate name, streets, are reeking with all manner of filth and abomination—horrible beyond description. If the traveler enters a hut it is merely to find that he has escaped from stenches in the outer air to get into worse inside. He passes the night as best he can, his ears constantly assailed by the groanings, the growlings, howlings and snappings of wild beasts, to come outside in the early dawn and witness a transformation scene. A miracle has been worked during the night—every particle of offensive matter has disappeared, and all the horrid effluvia of the night before "no longer taints the ambient air."

In the oases of the desert, as soon as night falls (which is with the going down of the sun, there being little or no twilight), the human ear is assailed by a deep and peculiarly grating sound, that comes from the hot barren sands surrounding one, outside the range of vision. It swells and grows, as it comes nearer, and soon the light of the camp fire shows, dimly, horrid shapes by the hundreds, and sometimes thousands, seated outside the area of brightness, gnashing their teeth and licking their chops in anticipation of the time when sleep shall have overcome the travelers and they can make a rush in and gather up any garbage thrown away.

They are hyenas, fearful to look on, but rarely dangerous to man. If there be a settlement on the oasis they over-run it streets and alleys, their hides reeking with filth; they howl and whine and yelp and bark, they fight each other for a bit of filth, and, as long as a particle of garbage remains, they rampage up and down in search of it. The first sign of dawn, which is followed almost immediately with the rising of the sun, they vanish, disappear, and seek the desert caves, there to digest their ignoble feast.

They have accomplished their mission well, however, in the meantime. The village garbage heap, piled no matter how high with the débris of a day—dead dogs

IN THE JUNGLE OF INDRAGIRI, AT SUNGEI DUNU.

or cats or fowls—sometimes a dead donkey, all the scrapings and unnamable garbage of the town—has vanished as completely as the beasts that cleaned it up. Not a little bit of a squirrel bone, not the wing of a locust, or a dead grasshopper remains! The people inhabiting the country have no fear of them, and travelers soon learn to look on their horrible and menacing grins, their bristled hair and burning eyes, as the harmless threats of cowards afraid of their own shadows. One man with a stout stick can (and frequently does) put to flight hundreds of them.

In spite of his great usefulness to man the hyena is abhorred. A coward, he never attacks a living animal unless it is weakened by sickness or enfeebled by wounds, and, even then, never directly, but always by stratagem or ruse. Sometimes he snatches an infant and carries it away, but it is said that he never kills his prey, carrying it to his burrow or den, and waiting for it to die and putrefy before venturing to mutilate its body. Yet he is a powerful brute, and if his courage equaled his strength he would be the most terrible wild beast of the desert. Like the jackal, he is timid to the utmost degree. The pair suit each other admirably—the one howls and the other makes frightful grimaces to scare his enemies. The hyena never attempts to put an enemy to flight in any other way than by making himself look fierce and terrible. He "wrinkles up his horrid brow with Olympian anger," displays his teeth and snaps them together in well dissembled fury; he sticks out his muzzle, raises his coarse and filthy mane (as much in fear as in rage), advances his shoulders an inch or two, as though he were about to make a charge on his adversary, yet a sharp "scat!" or even the motion of raising the arm, causes him to vanish in the desert with the speed of the wind. His bravery is all feigned—a by-play, repeated again and again with every chance meeting with man. No doubt, could he talk, he would shout: "Look on me and prepare to meet your God! See how terrible I am, O miserable scullion of a human being, and desist from opposing me!"

The rehabilitation of the hyena in the French African possessions has been talked of by those who know nothing of the beast, but it is sheer nonsense. His reputation is made, and even the great services that he renders the living in those regions cannot compensate for his outrages upon the dead. European civilization and European guns (pretty much the same thing!) will probably, in the near future, commence to make a notable diminution in their numbers.

THE PECCARY.

More useful than the hyena or the jackal, and far more agreeable in every way, is the little American peccary, a species of wild hog, found from Texas, in the North, to the pampas in South America, which is said to be at once a scavenger and a destroyer of creatures more noxious than himself.

A lively little beast is the peccary, quick of motion, always on the alert, fearless and rash. He is never found alone, but always in bands, some of immense size, coming no one seems to know whence, and going, none know whither—always on the keen jump, swift as an antelope, nothing stops them, neither jungle, nor hill, nor swift-flowing river. They swim as easily, apparently, as they gallop, and that is their gait by choice.

The bands are invariably led by a chief, always the swiftest and strongest of the herd, and he is followed by the males in serried column. The adult and strong females follow these, and the rear is brought up by the old and decrepit and the young. In marching, strict discipline is preserved, and they always go straight ahead, turning neither to the right nor the left. Whenever caprice dictates a new route to the leader, the fact is signaled in some manner, the turn is made abruptly, and at an angle (not a curve), progressing again in a straight line toward their new goal.

When a stop is made, or wherever they go, they fulfill a hygienic mission: Fallen fruits, insects, worms, ants (one of the most formidable foes to man in the tropics), snakes, lizards—in short, all living creatures that come in their way, as well as all vegetable debritus, etc., are consumed by them. If let alone they rarely or never attack man, but when opposed or first injured by him they become relentless and most vindictive enemies. When scattered foraging throughout the forest or the jungle, in the meadow, swamp or marsh, the cry of a wounded or injured peccary brings every individual of the band galloping to its aid, and woe betide the man or beast that they then encounter. Nothing but precipitate flight to some inaccessible place, up a tree or on some high rock, can save the object of their wrath. Notwithstanding this, they are said to be easily tameable, and to make docile and affectionate pets. Their flesh is excellent, the hams especially rivaling the best Westphalian.—Adapted from the French of Fulbert Dumonteil's Les Fauves Chiffonniers, for The National Druggist.

CYRTANTHUS OBLIQUUS.

THE flower shown in the engraving is a native of Natal, the land of strife, and is found on the Boschberg at an elevation of some 5,000 feet. English horticulturists have made a great study of the flora of South Africa. The flower illustrated was described in a recent issue of The Gardener's Chronicle, to which we are indebted for the engraving.

CYRTANTHUS OBLIQUUS—NATIVE OF NATAL.

THE GIANT TORTOISE OF THE BERLIN ZOO.

GIANT tortoises are rapidly disappearing. They are now to be found only on Aldabra—a small, lonely island in the Indian Ocean, north of Madagascar. Formerly they were caught in large numbers on Mauritius, Reunion, and Rodriguez.

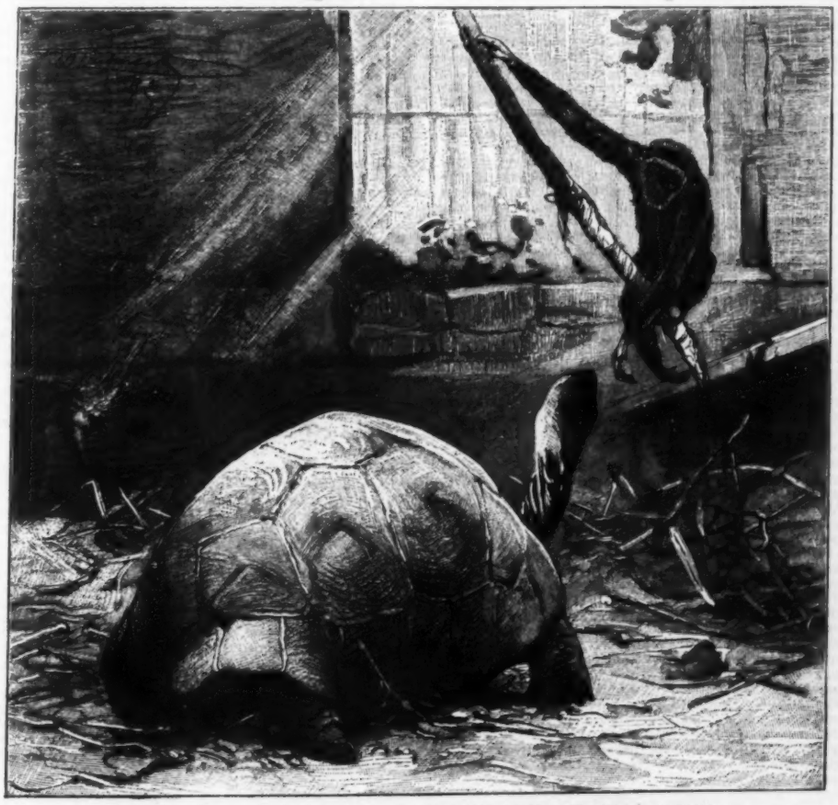
The first accounts of the existence of tortoises, many times larger than those known in Europe, are to be found in the writings of the explorers who visited the East Indies after the return of Vasco da Gama. The sailors who voyaged to South America in the early years of the 16th century found similar huge creatures on a group of islands which they christened accordingly, "Galapagos," or "Turtle Islands."

The destruction of the giant tortoise began almost with the discovery of the islands which it inhabited; for the early Indiamen looked upon it as a rich prize. Whenever a vessel touched at an island to replenish its supply of water a number of tortoises were captured and brought aboard alive. The animals were rarely fed, for they could live months in succession without food. And whenever the need of fresh meat was felt, a tortoise was killed to fill the want.

Giant tortoises were first exterminated, it seems, on the island of Reunion, during the 18th century; for they had multiplied in such numbers that they had become a pest. The islanders proceeded so systematically in their work of destruction, that the tortoises were completely blotted out of existence. Remnants of Reunion tortoises are not to be found even in museums. The inhabitants of Rodriguez and Mauritius soon followed the example of Reunion. Leguat, who in 1691 visited Rodriguez, writes that "there are so many tortoises that often herds of two or three thousand can be seen, and that a man can walk upon their backs for a hundred paces." Grant, in his history of Mauritius (1740), gives a similar account of the number of tortoises. Not a single wild tortoise is to be found on any of these islands. At the artillery barracks of Mauritius there is a single, domesticated, giant tortoise, said to be 200 years old, the last representative in these regions of an old, mighty species. The creature is said to have attained its present size in 1810. It was particularly mentioned in the treaty in which France ceded the island to England. The English authorities have taken the necessary steps to protect the few specimens still to be found on Aldabra. The six or seven species to be found on the Galapagos Islands are rapidly disappearing; extinction must soon follow the depredations of the inhabitants.

Zoologists have often remarked with interest the absolute similarity of giant tortoises living on islands remote from one another. The creatures have all the same long neck, small head and dark color. The high carapace and clumsy feet are characteristic of the true land tortoise. Living on islands on which flourished a luxuriant tropical vegetation which offered abundant food, unpursued by beasts of prey, they naturally attained, in the course of time, their astonishing size.

Within the last few years the various museums and zoological gardens have added giant tortoises to their collections. In 1895, Dr. Voeltzkow brought six specimens from Aldabra. They were kept for a year in the Hamburg Gardens. Two were then transferred to the Frankfort Zoo; and the remaining four were sent to England. The heaviest of these creatures weighed 226·6 pounds. In 1896, Dr. Aug. Brauer sent two more tortoises to Hamburg, the larger of which measures, when fully extended, 4·1 feet in length and 3·6 feet in width. It weighs 550 pounds. Both animals are still alive. Prof. Chun, last April (1899), brought home



THE GIANT TORTOISE OF THE BERLIN ZOOLOGICAL GARDENS.

with him several tortoises. One was presented to the Emperor and Empress, and is now in Potsdam; two were given to the Breslau menagerie, and a fourth to the Berlin Zoo. One remained in Hamburg. At the present time there are no less than six specimens in the Hamburg Gardens.—Dr. H. Bolan in Illustrirte Zeitung.

FILLETS AND ROUND CORNERS ON CASTINGS.*

By JOHN M. RICHARDSON.

TAKE some machine-tool casting, a lathe or planer, for instance, made from twenty-five to forty years ago, and compare it with one of the same class brought out at the present time by any up-to-date concern, and what is the first point of contrast noted? You will all answer, "the design." Wherein is this indifference of design? It is to a great extent in the large and smoothly-rounded curves and heavy fillets everywhere present in its outline. Broadly speaking, some of these old-style castings look as though a carpenter had nailed together some sort of a foundation, and then, visiting a planing mill, had procured a quantity of moldings, and with them trimmed it very liberally wherever possible, and finally, by some flourish of the magician's wand this would-be pattern had been suddenly transformed into iron and set down in the machine shop adorned with bright red and green paint, or a combination of both, neither "a thing of beauty," nor "a joy for ever." Sharp angles, fancy moldings, panels, etc., look very nice on doors, store counters and a great many kinds of furniture, but are decidedly out of place and likewise impracticable for cast iron.

I consider it of great importance to have a machine casting designed so that its exterior will present as smooth a surface as possible, and all angles and recesses of any kind provided with good liberal fillets. The advantage of this does not lie along any one line, but every one of the four mechanical arts, namely, drafting, patternmaking, molding, and machine work, which are so closely joined and interlocked as to be but four locks of a great chain, of untold strength and value to mankind, are each and every one benefited thereby. A drawing where this matter has received attention presents a much more finished appearance, and reflects credit on the designer, for it shows that he looked ahead as far as the foundry, realizing that the design and its resultant casting bear a close relationship to one another. Many a condemned casting is such not through any fault of the molder, but rather from bad proportioning of the metal, sharp angles, no fillets, etc., directly traceable to the drafting room.

In the pattern department fillets serve a very important purpose, and now I am treading on familiar ground, and, therefore, can without hesitation give a short outline of their merits and demerits.

A fillet is actually a pattern strengthener, aside from its foundry value, provided it is composed of a substance having some tenacity in itself, and, aside from this property, it is very often a time saver also, for in fitting hubs, bosses, and ribs over curved surfaces, or, in fact, any part fitting another where the intersection does not lie in a plane, much time and labor is required to produce a close fit, but a firm bearing can be quite easily arrived at, having, perhaps, rather open joints here and there, and here the fillet aids the patternmaker by effectually hiding the imperfection. The molder who keeps his eyes open will notice quite a variety of materials worked into fillets on the various patterns he handles, especially if he works in a jobbing foundry. Wood, leather, lead, beeswax and putty comprise the kinds ordinarily used, and they each have their time and place, except the metallic one. A pattern being of wood has a fibrous nature, which will hold glue or any other adhesive substance, while lead has no affinity whatsoever for glue; so the only thing that can be employed is shellac and nails. I have used yards and yards of lead fillets, so can speak from experience, and I have seen old engine beds and their foundation boxes returned for repairs, where these fillets were fairly stripped away from the pattern; even the small bung-head wire-nails used would not keep them anchored down.

Probably the finest fillet of all is made of wood, worked out of the solid pattern, having no feather edges whatever, but this is a very expensive kind, and can only be used on the finest jobs, so in everyday practice we have to add the fillet to the pattern as a separate part.

For fillets from 1 inch radius down to ¼ inch, leather is unquestionably the best and most practical material that can be used, and when properly applied will not peel up even with the hardest usage, and requires no nailing whatever, glue being the only agent employed. Those who condemn the leather fillet for patterns probably do not understand the proper method of applying it. There is a sort of trick about it, to be sure, the keynote of success being hot water. Cover the back of the fillet with thick glue, and place it quickly on the pattern, instantly drawing a round ended slicking tool of proper radius along its surface, bearing down hard to exude any superfluous glue, and following this with a woollen cloth, wet in very hot water, to remove all pressed out by the slicker. Repeat this until not a particle of glue squeezes by the edge of the fillet, then wipe with a dry cloth. This is really not so much of an operation as it may seem from the description, and many feet of these fillets can be applied in a very short space of time.

Where it is hard to bind the leather neatly around small curves, etc., just immerse it in hot water, taking it out instantly. This renders it perfectly pliable, but it means quick work, for the thin edges will shrivel and harden at once if not immediately placed in position and burnished down as previously described. A leather fillet put on properly with strong glue can only be removed when dry by main force, and will then come off with fibers of the wood adhering to it, and sometimes the leather itself will keep breaking—it takes so much force to make it let go. Light patterns are strengthened by them to such an extent that nails are frequently unnecessary. Beeswax is all right for very small fillets, and for finishing out where leather ones come together at the top edge of a rib when the curve is very small, and for many other places. The wax is prepared by being put in a cylinder, having holes of varying diameter in one end. This is warmed, and the wax forced through with a plunger, and then applied with a warm slicking tool of the right radius. If used too cold the fillet will not adhere firmly to the wood. In fact, it is hard to lay wax fillets satisfactorily in a cold room, for both pattern and wax are chilled to commence with, and the heated iron bearing on the top surface of the fillet only makes it difficult to communicate the heat evenly enough through the whole mass to secure a firm contact with the wood, and after the pattern has seen constant use in the foundry the wax will peel up badly; also it is not a durable substance for a fillet if sunshine or heat of any kind strikes it to any extent.

Putty has always been used in great quantities in patternmaking, and probably always will be, on account of its cheapness. Undoubtedly more feet of fillet can be applied in a given time with this substance for a given amount, taking both material and labor into consideration, than with anything else. But it is only adapted to cheap work, and not for standard patterns, as it is soft, easily dented, marred or bruised, besides imparting no element of strength to the work. In some places plaster of paris is added to it, to increase its durability, but when this is done it must be used immediately after mixing. Black putty is also frequently used. This is nothing but common putty mixed with lampblack, and is employed only on cheap work, having but one coat of shellac, this being applied after the sandpapering, thus comparing in color with the blacking on the pattern and saving a second coat.

When fillets are called for having a radius above 1 inch, then they must be worked out of wood, and this should be done after glueing to the pattern, not before, in order to have the feather edge adhere as firmly to the work as possible. It is almost impossible not to have the edge curl away if cut out first, and then fastened to the pattern, even if the precaution is taken to have the angle of the fillet made slightly greater than that of the corner it fits, in order to cause a binding of the edges.

A mold of any considerable size can be made more safely, quickly, and easily, and with a minimum of labor, where these points have been considered in the design and carefully followed out in the pattern, and with far more chances for perfect casting, as the danger of cracks in shrinking have been eliminated. How many castings are spoiled by having some slender part joined to a heavier one, with no fillet where they come together, thus causing a crack by the shrinkage strain at the junction, it would be hard to determine.

A pattern where heavily rounded, wherever possible, will certainly leave the sand very much easier, and with less danger of breaking the mold, thus saving labor in patching and mending, which is always a form of dead loss to the proprietor on day work, or to the molder on job work, besides being a great vexation to the workmen himself.

I would go so far to say that every edge of a pattern, except on surfaces to be machined later, should be rounded, even if the radius of curvature is so small on some light work, that it can be done entirely with sandpaper and on brackets, ribs, heading, etc., it is much more satisfactory when one gets accustomed to it to have the edges terminate in a semicircular section, rather than flat with the two corners somewhat rounded.

This rounding of outside surfaces is necessarily on the pattern itself, but there is something else frequently not on the pattern that is expected just as much to be on the casting, and that is, the fillets. How many molders can testify to getting patterns with chalk mark all round every corner and rib, and this injunction in two words, "cut fillets," also marked in chalk somewhere on the surface. Once in a great while a case occurs where this is justifiable, but it should be rare. A molder does not profess to be a sculptor, and when he is forced to carve out fillets in the sand who can blame him if, instead of being the radius of a circle, they prove to be the hypothenuse of a right-angled triangle. Then, too, there are often places in the mold where it is very difficult to do this without dropping sand down into parts where it is hard work to remove it, and the result will be an imperfect casting.

Another thing I wish to mention in this connection, although it does not show on the casting except by a fin, which must be clipped off before leaving the foundry, is still in the nature of a fillet. When a core is placed in position horizontally, and the cope closed down, the impression made by the core print where it joins the main pattern is liable to be crushed where it enters the body of the mold, unless the molder shaves off the corner so that at this juncture the core does not quite touch the edge. This shaving process is done as a foundry precaution, and varies from a slight amount on small work to perhaps ⅛ inch or more clearance all around where the core enters the mold, this gradually tapering off to the size made by the core print.

The fact of cores coming in the interior of a casting, and the places made by them being entirely out of sight, is a sort of "will-o'-the-wisp" to some, who imagine that fillets are unnecessary because they do not show. This is a great error. They are just as much needed here as elsewhere, to strengthen the casting, and to help resist shrinkage strains, and should be put in of a size proportioned to the casting to which they belong, but need not be made excessively large, as they frequently are on the outside of a pattern, simply for the graceful effect, for these are not seen. Their place is in the core box, and not as a production of the coremaker's trowel or file. It will sometimes happen that a fillet is called for, on what is the top or open end of a core box, thus making it impracticable for the patternmaker to provide for it. In such cases the coremaker ought not to object to making it in the sand, and as it comes within the casting, and is out of sight, a plain flat damper is all that is required, and the fillets already in the core box will be a guide for the size. Another case showing the utility of heavily rounded outlines and fillets on castings is when they undergo the cleaning process, and they will also pickle and peel off more freely, as there are no sharp corners for the sand to stick into, and thus time and the edges of the cold chisels are saved.

As we reach the machine shop, the man who snags the casting finds no sharp corners full of sand to be scraped out with old files, and as he scours his work down with the coarse emery brick preparatory to painting, he can do much more effective service, for as the stone becomes rounded on the corners with use, it will still clean the large fillets, whereas with sharp corners it would not, and finally, when the iron fillet is applied to one of these smoothly outlined castings, it can be sandpapered down easily and quickly, so that after the painting is completed, the effect, when properly done, is almost like velvet.

* Paper read at the Pittsburgh meeting of the American Foundrymen's Association

POLLUTION OF STREAMS, WITH SPECIAL REFERENCE TO THE CHICAGO DRAINAGE CHANNEL.*

AMONG the most vital questions of the day, that concern the present and future welfare of our cities, none is more important than the question of water supply. Very few, if any, of our centers of population are so fortunately situated as to possess an abundant supply of pure water, free from contamination. Cities that have thought themselves to be thus favored have found that, under conditions of increased population at home or in other cities, not always or necessarily near to them, their supposed water supply far from being pure and wholesome, has become polluted, unfit and dangerous for human consumption. Particularly is this true of all our cities depending upon streams for their water supply. The day has gone by when it is necessary to support with argument before engineers the proposition that pure water cannot be drawn from a stream flowing through a settled country and receiving the dejecta of its inhabitants. It has now become a question of how long and to what extent such conditions will be allowed to prevail before the evil consequences thereof are recognized by the majority of our people, and the proper remedies demanded and applied.

To my mind, there is one question in connection with water supply paramount to all others, which should first be decided by the people of the United States, before our cities are required to adopt and put into operation plans for water supply or sewage disposal. I mean the general question as to whether our rivers and streams are to be, in the future and for all time, the protected sources of pure water supply, from which all communities may safely draw, or whether they are to be open channels into which every community may discharge, without question or fear of legal opposition, manufacturing refuse, offal and filth of every kind and description. Ultimately, there can be no middle ground, as at present. Our streams will be pure, or they will be foul. If the people decide that they are to be foul, what follows? Evidently they cannot then be sources of water supply. Where, then, are we to look for our water? There remain only two sources, lakes and wells. It is possible to supply from the Great Lakes upon our northern border a very considerable territory. In many of our States numerous small lakes are to be found that contain ample supplies of water which, under proper legal supervision, can be maintained in a state of purity. In rural districts wells and springs must continue to furnish the inhabitants with water. With large inland cities located upon polluted streams, or upon no streams at all, the latter case being very rare, the problem of water supply will become very difficult. In certain sections, where such a condition prevails, water may be secured by means of artesian wells, but in many localities, as in St. Louis, artesian wells furnish either salt water or water impregnated with various mineral salts, rendering it unfit for domestic use. Such cities will, by reason of their geographical position and the fouling of their natural source of water supply, be compelled to convey water in most cases from great distances, and at an expense which cannot fail to be a great burden upon their people. Naturally, in such cases, the first thing thought of, and in most cases the last thing done, is to resort to filtration. As to what results may ultimately be accomplished by improvements upon present methods of filtration, the best-informed upon the subject do not now feel warranted in making conclusive statements of their opinions. We know that much can be accomplished in this direction. We know that nearly all suspended matter and a very large percentage of bacteria may be removed by filtration. We know that soluble salts are not removed by filtration, but require chemical precipitation. We know also that the typhoid fever bacillus will pass through every description of filters known. We know that a certain percentage of typhoid fever bacilli are destroyed by filtration processes, but we do not yet know what that percentage is. I believe we know enough about filtration to-day to plant our feet firmly upon one unassailable proposition, and that is that all water intended for domestic consumption should be filtered. The best is none too good. Therefore, upon the proposition that our streams are to be pure, let us make them as pure as it is practicable for us to make them. First of all to this end, we must by proper legislation prohibit absolutely the discharge of raw sewage into our streams and lakes. We must also protect them as much as is possible from surface contamination.

We are now in a makeshift stage uncertain of our ground, each city trying to make the best possible temporary provision for its own people, and I am afraid in most cases having little thought and less care for others. Granted that this is true, I do not propose to apologize to or for the American people. The condition is natural, and what might fairly be expected in a government as young as ours. In many older, and supposedly much more enlightened countries, we know that there is the same spirit of self to-day, your neighbor to-morrow. Boiled down, it is but the human expression of nature's first law, self-preservation; and, so regarding it, we recognize the almost insurmountable difficulties to be overcome by the few before the many can be made to see that nature's law of self-preservation is not restricted necessarily to individual preservation. Self preservation may, and often does, mean the preservation of multitudes with self. It is always the case that the first conceptions of so-called natural laws as well as of human laws, are selfish. We are prone to see in our own interpretations all the possible privileges and advantages secured to us, and all the restrictions placed upon our neighbors.

Nature works out her problems in long periods of

* Address by B. H. Colby, retiring president of the Engineers' Club of St. Louis. Read at the Annual Dinner, December 28, 1899, and published in the Journal of the Association of Engineering Societies.

time, and we should not be despondent. It is none too soon to teach the golden rule, but it is too soon to expect the majority to follow it. The world is young, and in the future there is time. As Emerson puts it, "Man is no upstart in creation, but has been prophesied in nature for a thousand ages before he appeared; from time incalculably remote there has been a progressive preparation for him, an effort to produce him. The meaner creatures contain the elements of his structure, and point at it from every side. His limbs are only a more exquisite organization—say rather the finish—of the rudimental forms that have been already sweeping the sea and creeping in the mud; the brother of his hand is even now cleaving the Arctic Sea in the fin of the whale, and in innumerable ages since was pawing the marsh in the flipper of the saurian." Let us be patient. If it took countless ages to produce the animal man, as we all believe with Emerson it did, how many ages will it take nature to produce the intellectual part of man—the man with the divine mind, with the broader interpretation of natural law, to whom and with whom the practice of the golden rule is but the natural expression of his being? This is dealing in futures—a long way in the future—but until the golden rule man is here, and in the majority, we cannot expect golden rule laws. Our lives and the lives of many generations after us will have to be lived under conditions little improved upon the present. Our problem is not how to deal in futures, but with the present. How to obtain the best possible for all living; how to make the best use of what we obtain; how to preserve the fruits of our labor for those who are to come after us. With lesser aims we are degenerates.

Now let us come back to water supply and its related subject, sewage disposal. How are we to obtain the one and dispose of the other? Must we wait for the golden rule man to be in the majority? Shall we go about like fat oxen, feeding off the bounties of nature, receiving sustenance from her lavish hand, but returning to her nothing but our dust, content with our sleekness? Or shall we try to adapt her great resources and forces to the use and benefit of man? I hold that nature's resources and forces lie in the animate as well as in the inanimate, and that it is just as much the province of the engineer to develop, utilize and control the great animate mind forces of nature for the use and benefit of man as it is the inanimate forces. No man can be a great engineer, or great in any other profession, until he can in some measure control mind forces. A great man must be enough of a leader to secure followers; must have those behind him who are willing to back his opinions with their purses; the mind has to be led before the purse can be commanded; without the money bag engineering structures are impossible. Engineers must first of all inspire confidence in the utility and practicability of their proposals. No great undertaking was ever begun and carried to completion without confidence. Sometimes there are more who are confident of your failure than there are those who are confident of your success. Especially is this so if we leave the beaten track of common practice. But at times leave the beaten track we must, and it is my opinion that we must do so in the case of water supply and sewage disposal. Perhaps I should reverse the order, as in many cases sewage must first be taken care of before pure water is possible. This means that every city, every town and every factory which is now discharging sewage or refuse into streams or lakes must by legal enactment be made to render harmless, by proper treatment, all of their sewage and wastes before emptying the same into bodies of water which are, or which might be, used as sources of water supply. But how is this to be accomplished? I answer by Federal law. I can see no other way. We cannot rely upon State statutes or upon municipal ordinances in this matter. The majority of the people are too selfish to incur the necessary expense to protect their own lives. They are content to take their chances. Then, too, communities are justly slow in assuming great expense which, after all, only partially protects their interests, requiring for complete protection similar concerted action and expense from other communities before the benefit sought is received, The same can be said of State governments, leading us up to the absolute necessity of a general Federal law which shall require every city to pay for rendering harmless to others its own sewage before turning it into streams from which less favored cities must, by necessity, draw their water supplies.

To be as nearly correct as possible in my statements of existing laws in relation to river pollution, I asked my friend, Prof. W. S. Curtis, dean of the St. Louis Law School, briefly to note and comment upon such laws as he could readily find upon the subject. In substance, Prof. Curtis says, "Upon the subject of pollution of rivers there is no Federal statute. Some of the States may have, but such laws would be local and of no 'interstate' effect. The English have an act called 'The English Rivers Pollution Act,' of date 1876." As to common law, Prof. Curtis says, "Without doubt everywhere, in both England and this country, the common law, as distinguished from statutory enactments, protects the rights of lower riparian owners and dwellers as against those living higher up in all customary uses of the waters, including the right to have the water free from pollution; the only question is as to now far (as against how slight a pollution) the right extends. A case illustrative of this right is in 119 California Reports, page 387. The use of river waters for drinking purposes is comparatively modern; that is, in the wholesale way of water works in our great cities. In the absence of statute, and relying on common law, there is no doubt the lower river dwellers, in protection of rights to use water by water works, would have a good standing in court, as against such a wholesale pollution as that threatened by the Chicago Drainage Canal Commission; and all the more in this case because the commission is to accomplish its object by lifting the waters; in other words, by changing the natural configuration of the drainage." He adds, "There is danger in sleeping on rights while expensive and ostensible preparations were being made by the commission. If any preventive legislation follows, it will turn upon expert examination as to the probable extent of the pollution, and upon the question how far rights have been lost by postponing interference. An entirely different question is presented at lake cities, in the navigation interests involved, consequent upon the possible lowering of lake levels by the diversion."

So much Prof. Curtis gives. I may add that all navigable waters in the United States are under Federal control; that no State, city, company or individual, except by Federal authority, has any right whatever to their use. Doubtless purely commercial reasons were at the bottom of this fundamental principle of Federal control at its inception. The same reasons that induced the great men who framed our Constitution to invest Congress with this regulative power as to navigation exist to-day in a tenfold ratio, and the necessity for such power is a thousand times more apparent now, after one and a quarter centuries of internal development and progress, which at the time of the adoption of our Constitution were undreamed of by the forefathers. There were no large cities then. There were no polluted streams, and the question of water supply upon the scale now necessary throughout the length and breadth of the land would then, if thought of, have been believed absurd.

From the adoption of the Constitution to the present day the Federal government has assumed a firm control over all navigable waters, and over all the land of the country as well. From time to time it has enacted laws for the use of the waters and the disposition of the land. There is a small minority who maintain, with what appears to be much more of zeal than of sense, that the Federal government should not dispose of its land to individuals, but should hold it in trust for those who, in return for the privilege of occupation or cultivation, are willing to bear all the expenses of our National, State, municipal, county town and township governments. That the policy of the gift of homesteads by the government to settlers and the sale to others who desire larger farms is a wise policy and approved by the great majority of our people is unquestioned. But I have never heard of any of our people advocating the gift, sale or lease of any body of navigable water lying within the borders of our country. It is impossible to conceive of such a proposition being made in seriousness, and should any unbalanced legislator have the temerity to bring a measure before Congress providing for the sale, lease or control of our navigable waters to the highest bidder such an one would raise a tidal wave of righteous indignation and protestation such as would render his residence in foreign parts convenient, if not obligatory, for all future time. But, important as the interests of navigation have become at the close of this century, and vital as the principle of Federal control of navigable waters seems to our people, we are beginning to see that there is another and more vital reason for the exercise of Federal authority in this matter. Pure water is one of God's best gifts to man. As long as there is enough for all, questions and contention as to its use do not arise, and much latitude is permitted users, but whenever great care is necessary to preserve the purity of a water supply, public safety demands that those who refuse to regulate their actions for the general good be compelled to do so.

A city has power to regulate and control its own people; a State has the same power over the city, and the general government has the power to enact laws which all must observe. Within their own borders it is in the power of cities to establish sanitary regulations, and neglect or refusal to make abequate provision in this respect to a degree that threatens to jeopardize the health of adjacent districts is legal ground for the State to step in and compel enactment and observance of proper relief measures. Such relief, however, is confined to one State, and, although local relief may ensue, the unsanitary condition is only too frequently transferred to another locality and, as is often the case, to another State.

The past history and present condition of water contamination in this country justifies the positive assertion that the subject will never be satisfactorily dealt with by either State or municipal law. The sooner this fact meets general recognition by the public, the sooner will our representatives in Congress enact a general law that will protect our water supplies from pollution for all time to come. That such a law would be cheerfully obeyed by all the States I have no doubt, and that such a law will be enacted in the near future I am equally confident. Toward this end the people of St. Louis have contributed in full measure, and it is but just to add that the beginnings of the movement that will finally lead to Federal action had their origin in the Engineers' Club of St. Louis. The leaven here prepared has raised a discussion that has become national in its scope. This agitation has led, this very month, to the introduction into the United States Senate by a Senator from Missouri of a bill which is I believe, the entering wedge that will open the way in two or three years for the passage of a general Federal law controlling the pollution of navigable waters and the sanitary disposal of sewage and wastes. The bill provides for the expenditure of $10,000, under the direction of the Surgeon-General of the United States Army, to investigate the pollution of streams. I believe that the bill will pass; that in due time a report of such investigations will be made to Congress; that the results obtained will be found of such practical value that additional and larger appropriations for continuing the investigations will be made, and that, when final results and reports are made, the showing as to the great necessity of Federal action will be so conclusive that the outcome will be the appointment of a joint sanitary commission from both branches of Congress to prepare and report for approval a general law to prevent the future contamination of water supplies. St. Louisans may then be justified in a feeling of pride in their efforts in helping along the good cause; but in our time of elation we must not forget that our efforts came in part from necessity, not from inherent virtue; that, had the conditions been reversed, we might have been just as apathetic as our neighbors. But I am again dealing in futures. We have no Federal law, and we are drawing our water from a sewage-polluted stream. Present conditions are bad enough, but we are menaced with a condition of things that ought to raise our ire to the sticking point. A city, 300 miles away, is preparing to transport and to dump into our water supply at our very front door the refuse and filth from two millions of people. Think of it a minute! Conceive of it as it is; you cannot. Visit the Bridgeport sewage pumping works in Chicago, as some of you have done, and you will know that I do not exaggerate when I say that nowhere upon the face of the earth is there to be found another stream as deadly foul as is the Chicago River. Receiving, as it does, a large part of the surface washings and the discharge of most of the sewage of a dirty city, its pollution is still further augmented by the refuse from the largest stockyards and slaughterhouses in the world. I wish I could cause the inhabitants of St. Louis to march in single file past the sea of nastiness pumped from the Chicago River at this point, a sea which flows away in a channel called the "Illinois and Michigan Canal," but which is, in fact, nothing but a good sized river filled with the filthiest filth that ever flowed forth to join a stream from which other cities do and must take their water supplies. With such an object lesson there need be no sermons, no public agitation to arouse the people of this city to the danger that threatens them. Rather would it require cool heads to restrain them from doing violence to the "sewage ditch." After seeing Bridgeport and following for miles the swiftly-flowing stream of filth, no sophistry could ever induce the most ignorant citizen to believe for one moment that ten times the proposed amount of dilution from Lake Michigan could ever render this mixture fit for human throats. Neither could he be made to believe that sedimentation takes away from the mass all that is injurious to health. He has followed that stream, has seen the much-mooted sedimentation and knows of his own knowledge that death is there.

Yes, sedimentation does take place; thousands of tons of filth settle annually upon the sides and bottom of this famous ditch; canal boats pass over it and help to liberate the gases from the putrefying mass; myriads of bacteria find their birthplace there, and are borne along upon its dark bosom to the Mississippi River. Some of them, Dr. Ravold* says, find their way into the intake of our water works. Is there a man here who does not believe Dr. Ravold is right? Once in the intake there is no way to escape; they are distributed under 45 pounds pressure, to be mixed next morning with our porridge. We are now receiving the discharge of such a death-dealing stream. If the legal efforts now being made by our city officers to stop this pollution are not successful, we shall soon be deluged with another stream, larger and still more dangerous. It will bring into our water supply a contamination and pollution never experienced before. It will sow the germs of disease and death broadcast among our people. The stream will be broad and deep, lined with festering foulness and 300 miles long.

As engineers and as citizens let us be alive to the danger that confronts us. Our first step should be filtration. What do we lack to secure the filtration of our water supply? Can you answer it? We have competent engineers. We have the will. We have the money. What more is lacking. The power is lacking. What a confession to make. We, the people, lack power to accomplish our will. Shame upon us. But we have that reserve force within us, latent though it has been, that is all powerful. Let us exercise it. Let us send to eternal oblivion those who seek office solely for private gain; those who regularly defeat every measure for the public good. Let us make it our business to put men in our municipal assembly who work for, and not against, the interests of St. Louis. It is there, and there only, that we need power. Then let us, one and all, work to secure the permanent remedy, not ceasing our efforts until we have secured the enactment of a general Federal law for the sanitary disposal of sewage and the prevention of water pollution.

*Bacteriologist, Health Department, St. Louis, Mo.

STONE CARVING MACHINERY.

MR. CHARLES BARNARD in a comprehensive article in the April Century on "The Industrial Revolution of the Power-Tool," gives this picture of the work, not yet fully completed, on the new Appellate Court House, Madison Square, New York City:

The marble carver can, for a short time, give thirty blows a minute with his wooden mallet on his chisel; his average speed is probably less. With a pneumatic hammer he can strike two hundred, two thousand, three thousand, or six thousand blows in one minute, without the slightest exertion on his part. He can regulate the number of blows in each minute at will. His flying hammer fits any form of chisel used in his art. It will enable him to do any work he can do by hand, and many things that would be impossible without his nervous little hammer. His hand, eye and mind are now free to give their whole attention and skill to guiding the chisel. All the labor (one-half of the total labor) of striking the blow on the chisel is released. Just that amount of mental and physical energy is released to work in the real art, which is the guiding of the tool.

An example of the economy thus afforded is found in the elaborate exterior decorations of the Appellate Court lately erected on Madison Square, New York City. The building is of steel frame with white marble facing. As required by law, a massive timber stage, or platform, was erected over the sidewalks, and on this the stone, bricks, steel beams and other material were deposited while being prepared for the steam-derrick that lifted each piece into place. The blocks of marble arrived already squared, shaped, and fitted, so that the work of the builder consisted merely in putting them in place in the wall. All the blocks that were to be decorated, capitals, lintels, panels, sides of windows, in fact every block that was to carry any part of the ornamental work, was left rough, and was set in the wall just as it came from the marble yard.

As the walls were erected, a wooden staging was placed before them for the convenience of the marble workers. On the platform stood a small shed, sheltering a 12-horse power gas engine operating an air-compressor. From the compressor wrought-iron pipes extended all over the staging. At intervals there were little hydrants to which rubber hose could be easily attached. Here we have the distribution of power clearly illustrated. The gas engine using street gas has a distinct advantage over the steam engine, as its fuel is brought in a pipe instead of a cart, and has no ashes to annoy the passer below. In fact, were it not for the barking of its exhaust-pipe one would never imagine that a power plant was at work overhead.

At one time eighteen marble workers were employed on the building. Each one had beside him a plaster copy of the decoration he was to reproduce in the

marble. His light steel hammer, with its swiftly flying chisel, cut the marble easily, surely, evenly. Rose and leaf, lintel, curving line, flowing tracery and flowering capital grew as if by magic under his hand. The beautiful forms of the pattern, or model, appeared with incredible speed. The chips flew in a fine shower of white dust under the lightning-like hammer. The long, flexible hose enabled the workman to stand in any position and hold the tool at any angle, and its tireless energy relieved him from everything except the skilled work of guiding the tools. He could stop in an instant and change the tool in less than a minute. The workman is no longer a skilled laborer, he is an artisan, with a new tool that relieves him from all labor.

THE BOLLÉE VOITURETTE.

THE vehicle invented by Leon Bollée, although built on the lines of the tricycle, approaches the automobile more nearly than any motocycle which has yet been devised. It can be called a "voiturette" or light road carriage without unduly stretching that very elastic term. In the motocycle the motor is supplemented by foot power. But in the voiturette, the motor is the only driving mechanism. In order, therefore, to produce a voiturette, Bollée was compelled to construct his tricycle on an entirely new principle. Instead of a motor whose speed varies with that of the vehicles which it drives, a motor is employed which runs at a uniform rate, a governor being provided to maintain a constant number of revolutions.

Since the motor rotates uniformly under all conditions, it would be impossible, if the driving-wheels and motor were permanently connected by gearing, to modify the speed of the vehicle, and to throw the motor out of gear. A device is, therefore, indispensable by means of which the speed can be changed at will. Differently-sized gears enable the driver to run his vehicle at various speeds without altering the number of revolutions made by the motor. Any one of these gears can be thrown into engagement with the motor shaft, the differently-sized gear wheels producing different rates of speed. It is not advisable to force the speed of the carriage above that given by the largest gear wheel by increasing the speed of the motor. The lubricating and cooling apparatus, and even the carbureter, are arranged to coact with a motor of predetermined power; and the attempt to increase that power is a most dangerous experiment, followed usually by serious results.

When it is considered that the motor used on the Bollée voiturette develops two, three, and even four horse powers, inspiring and compressing, therefore, a large quantity of gas, and consequently requiring the expenditure of some energy in starting it, the necessity of constantly keeping the motor in operation while the carriage is both in motion and at rest is apparent. By means of a clutch mechanism, the inventor is enabled to throw his motor into and out of gear, thus attaining the desired end.

A cursory examination of Figs. 1 and 2 shows that the parts of the Bollée carriage can be divided into three groups. The first group consists of a fore-carriage containing the steering apparatus. The two front wheels are turned to the right or to the left by a steering handwheel which the driver turns with his right hand. The second group includes the mechanism in the center of the carriage for the transmission of power and the changing of the speed. Above this mechanism the driver's seat is located, within easy reach of which is a lever controlling the speed-changing gear and the clutches for throwing the motor in and out. A pedal-brake controls a shoe to be forced against the periphery of the flywheel. The third group contains the motor and its appurtenances.

If the seat-cushions be removed from the casting which protects the moving parts from dust and mud, and the front and rear portions of the casing be unscrewed, the mechanism of the carriage will be exposed. Fig. 3 shows the entire carriage with its parts thus laid bare.

The frame consists of two parallel steel tubes, similar to bicycle tubes, but much larger in size and capable of withstanding greater strains. At the forward end of the carriage these tubes are connected by a long cross-tube, and at their middle and rear portions by shorter tubes. The frame is essentially a horizontal rectangle in form, stiffened by braces.

It is one of the peculiarities of the Bollée voiturette that all the parts are directly secured to the frame without intermediate springs, by means of rings and bands, so that they can be removed and replaced by a simple key.

The fore-carriage (Fig. 4) serves to steer the vehicle. The front cross-tube or brace of the frame carries the two posts, *C* and *D*. The post, *D*, at its upper end is formed with a ball head, upon which is mounted an arm jointed at its middle. The rear portion of the arm is provided with teeth to form a rack which engages a small pinion turned by the handwheel, *A*, and carried by the tube, *F*, extending rearwardly from the post, *D*. By turning the handwheel, *A*, the rack is reciprocated to actuate the front wheels of the carriage. The post, *D*, which is connected with the front end of the jointed arm, is turned to the right or to the left by the action of the handwheel upon its rack and communicates this motion to the steering-wheel with which its lower end is connected. If the handwheel be turned from left to right, the rack is moved backward and the front wheels turn to the right; if the handwheel be rotated from right to left, the rack is pushed forward. The movements of the handwheel, *A*, and of the right front wheel are simultaneously communicated by a connecting rod to the left front wheel. The small cranks, *G* and H, pivoted to the connecting rod, transmit the slightest motion of the right wheel to the left wheel, so that both wheels turn together. This steering gear is simple and safe.

The rear carriage of the Bollée voiturette consists of a single rear wheel and of the motor and auxiliary apparatus. Referring again to Fig. 3, it will be observed that to the right tube of the frame, the benzine reservoir, *A*, is secured. The benzine is conducted to the carbureter by the pipe, *C*, controlled by the valve, *B*. As the reservoir is placed somewhat above the carbureter, the benzine will flow in a constant stream to the carbureter upon opening the valve, *B*. By means of a float the benzine is maintained at a uniform level in the carbureter and is thence conducted to a vaporizer and mingled with atmospheric air. The explosive mixture thus formed passes through the pipe, *E* (Fig. 3), into the explosion chamber, beneath the cap, *F*, of the admission valve.

The piston reciprocates in a cylinder, *G*, provided with flanges, whereby a large heat-radiating surface is obtained. The gas inspired by the first stroke of the piston is compressed on the return stroke and exploded by an incandescent platinum tube protected from the wind by the perforated shield, *N*.

The burner receives its fuel (benzine) from a small reservoir located behind the driver's seat (Figs. 1 and 2), the fuel being supplied by a pipe, *M*, extending beneath the frame. After ignition and after the end of a working stroke, the burnt gases are driven back by the piston and forced out through the exhaust valve (not shown in Fig. 3) into the exhaust muffler, *K*, thence to be discharged into the atmosphere. It may be remarked in passing that the governor of the motor controls the exhaust valve. The piston is lubricated with oil supplied by a cup, *H*.

On the motor shaft driven by the piston rod and crank, three gear wheels of different sizes are keyed. Parallel with the motor shaft, appearing above the oil cup, *H*, in Fig. 3, is an auxiliary shaft also carrying three gears of different sizes. The auxiliary shaft can be laterally shifted by the lever, *L*. Further to the right, part of a pulley is seen, rigidly secured to and rotating with the auxiliary shaft. This pulley always maintains the same position relatively to a second larger pulley which, in Fig. 3, is visible between the benzine reservoir, *A*, and the driving wheel, to which it is secured.

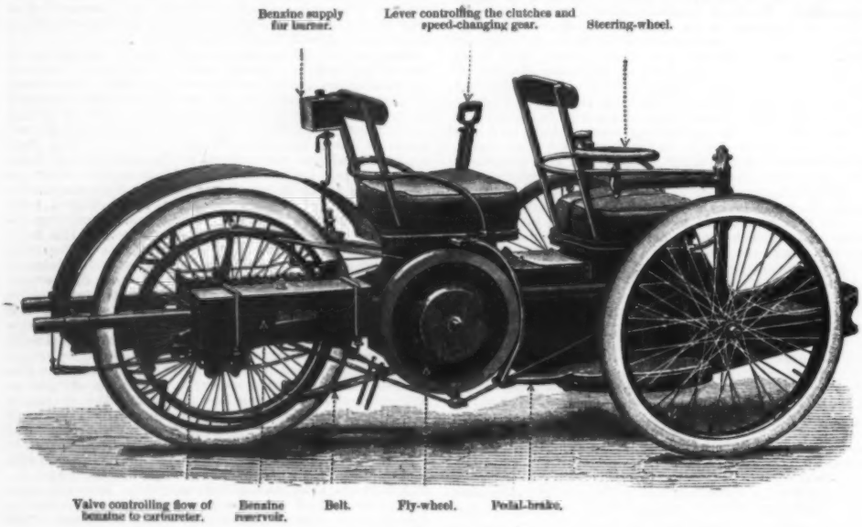


FIG. 1.—BOLLÉE VOITURETTE (RIGHT-HAND SIDE).

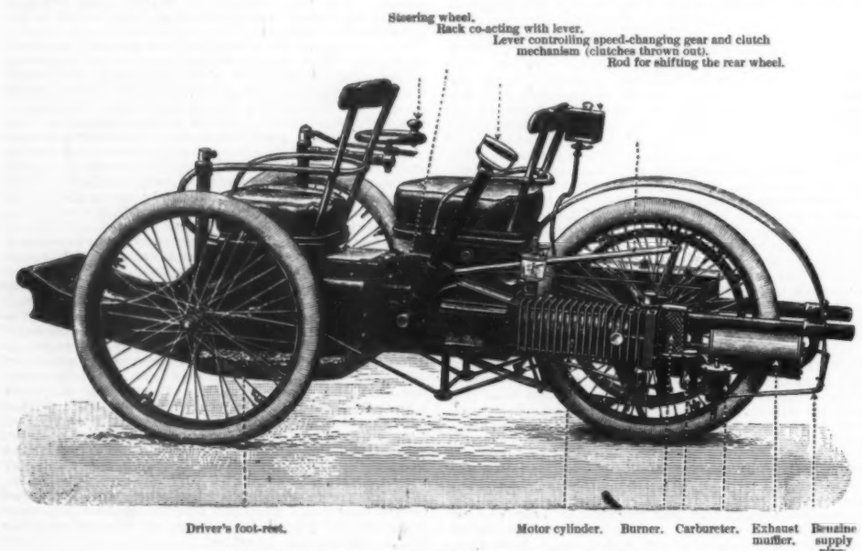


FIG. 2.—BOLLÉE VOITURETTE (LEFT-HAND SIDE).

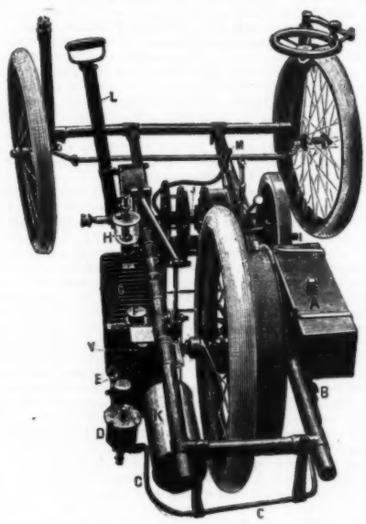


FIG. 3.—TOP VIEW OF THE BOLLÉE VOITURETTE.

FIG. 4.—THE FORE-CARRIAGE.

By means of the lever, *L*, any gear of the auxiliary shaft can be thrown into engagement with a gear of the motor shaft. The motion thus given to the auxiliary shaft is transmitted by the pulleys to the rear driving wheel through the medium of a belt. By means of a lever, *L*, the tension of this belt can be regulated. The lever has still other duties to perform; indeed, it constitutes one of the most ingenious devices invented by Bollée. It serves not only to shift the gears of the auxiliary shaft, but also to tighten and loosen the belt by moving the rear driving wheel back and forth, and to force the pulley of the driving wheel against the brake shoe on the frame.

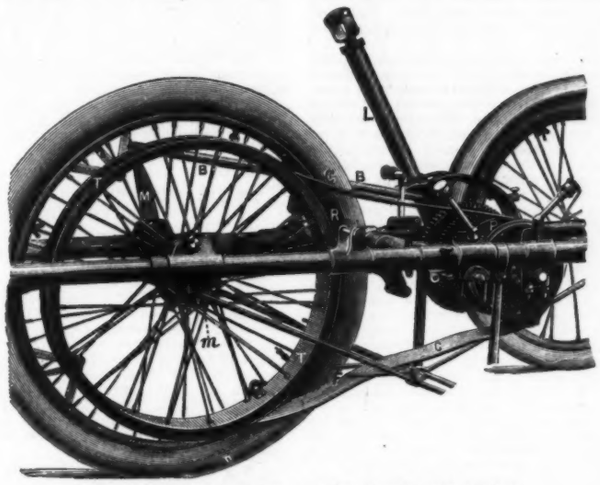


FIG. 5.—LEVER IN BELT-LOOSENING POSITION.

FIG. 6.—DETAIL SHOWING THE LEVER AND ITS QUADRANT.

The lever is so mounted that it can be moved back and forth and from side to side. To tighten the belt and start the carriage, the lever is pushed forward. To loosen the belt, it is pulled back (Fig. 5) and the belt drops into the prongs of the fork, *F*. By pulling the lever further backward, the driving wheel is shifted still more to the front and the large pulley, *T*, is forced into engagement with the brake shoe, *R*, to retard or stop the carriage. Even though the motor continue to operate and the auxiliary and motor shafts be geared together, the driving wheel will be checked by the brake shoe; for the belt, *C*, connecting the two pulleys, *P* and *T*, has not sufficient tension to transmit power. The vehicle is, therefore, quickly brought to rest by the brake.

In order to simplify the operation of the lever and to maintain the tension of the belt without the necessity of the driver's holding the lever in position, a toothed quadrant, *S*, is secured to the frame (Fig. 6), which quadrant is engaged by a triple-toothed dog which holds the lever in adjusted position. The lever is constantly pressed against the quadrant by a flat spring, *R*, so that the dog is always in engagement with the teeth of the quadrant. To disengage the dog, the lever must be pushed to the left. Very little practice is required to move the lever into the different positions necessary to operate the speed-changing gears, pulley, and brake. After having been moved to the proper position and released, the lever is immediately locked in place by the action of the spring, *R*. The movements of the lever, *L*, are communicated to the rear driving wheel by a lever, *A* (Fig. 6), pivoted to a link, *B*, connected with another lever, *M* (Figs. 5 and 7), on the lower end of which the driving wheel is carried.*

FIG. 8.—VARIABLE SPEED-GEAR.

FIG. 7.—DETAIL SHOWING THE SHIFTING DEVICE FOR THE REAR WHEEL.

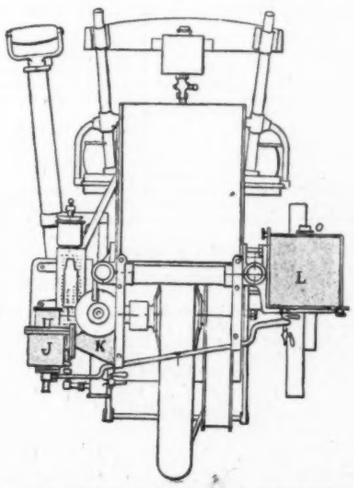


FIG. 9.—DIAGRAM SHOWING ARRANGEMENT OF THE BENZINE-RESERVOIR (*L*), AND THE CARBURETER (*J*).

The driving wheel is not journaled directly on the frame of the carriage. Its axle, as shown in Figs. 5 and 7, is located beneath the tubes of the frame, so that it can be shifted in accordance with the movement of the lever, *L*. The axle at its left end is connected with the lower end of the lever, *M*, and at its right end with a small lever, *m* (Fig. 7), the pivotal points being located above the tubes of the frame.

The driving wheel is, therefore, suspended from the ends of these levers. The left-hand lever is double armed, the longer arm being designated by the letter, *M*. The right-hand lever consists of a single arm only, a long arm being unnecessary, since *M* and *m* are always parallel.

The motor shaft and its gears have only rotary motion; they cannot be laterally moved. The auxiliary shaft, on the other hand, is so mounted that it can be shifted to bring any of its gears into engagement with one of the motor-shaft gears (Fig. 8). The lateral movement of the auxiliary shaft, however, must not affect the pulley, *K*, for the driving belt must be constantly kept in alinement with the two pulleys which it connects. The pulley, *P*, is, therefore, mounted only loosely so that it is not affected by the movement of the auxiliary shaft. But since the pulley must transmit the rotary motion of the auxiliary shaft to the rear wheel, some means must evidently be provided for connecting it with the shaft. These means consist of a flange engaging a groove in the pulley.

The lowest speed is attained when the largest gear, *A'* (Fig. 8), of the auxiliary shaft engages the smallest gear, *A*, of the motor shaft; and the highest speed when the gear, *C'*, meshes with the gear, *C*. By means of the gears, *B* and *B'*, an intermediate speed is obtained. The three pairs of gears respectively correspond to speeds of five, ten and fifteen miles per hour. By changing the proportions of the gears, higher speeds can be obtained.

The speed-changing gear is inclosed in a metal casing hermetically sealed to protect the mechanism from dust and mud. A door is, however, provided for the inspection of the gears and the introduction of oil.

FIG. 10.—THE CARBURETER.

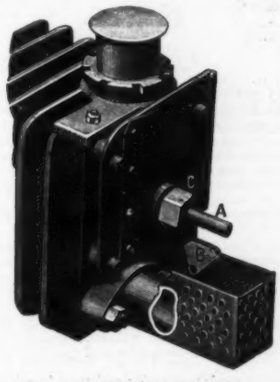


FIG. 12.—THE IGNITER.

The motor of the Bollée voiturette is of the usual four-cycle type. During the first period, gas is drawn into the cylinder by the action of the piston. On the return stroke of the piston the admission valve is automatically closed and the gas is forced into the compression chamber and there compressed (second period). During the third period the compressed gas is ignited by an incandescent tube in one end of the compression chamber, the resulting explosion driving the piston forward again. The third period is, therefore, a working period. On the return stroke of the piston, the products of combustion are discharged through the exhaust valve (fourth period). The cycle then begins anew.

As shown in Fig. 9 the benzine reservoir, *L*, is placed

* The bent fine-like device projecting above the link in Fig. 6 is a lubricator. Similar contrivances are to be seen in Fig. 5. All serve to lubricate the bearings of the shafts.

somewhat above the carbureter, *J*. Valves are provided to draw off the sediment and the benzine too heavy for carburation. The carbureter is shown in Fig. 10. It deserves more than a passing notice, for it is one of the best vaporizing devices ever invented.

The "Phœnix" carbureter, as it is known, comprises three parts, *M*, *N* and *O*. In the first compartment, *M*, the benzine is kept at a constant level. The second compartment, *N*, is an air chamber. In the compartment, *O*, the benzine is vaporized and mixed with atmospheric air. The benzine enters the carbureter by the pipe, *A* (Fig. 11).

If no regulating means were provided, the benzine within the carbureter would seek to attain the same level as that in the reservoir, in accordance with the well-known law that fluids contained in two connected vessels tend to find a common level. The benzine, as a result, would flow from *A* to *B*, completely fill the compartment, *M*, pass through *F* and *G*, and finally overflow at *J*. A float is, therefore, provided to maintain the benzine at a constant level.

The explosive mixture of air and gas is ignited by a burner protected from the wind by a perforated shield (Fig. 12). The ignition tube, *A*, located immediately above the burner, *B*, is secured in the wall of the explosion chamber by means of the nut, *C*. The tube shown in the engraving at one side of the shield conducts the explosive mixture to the compression chamber. The platinum tube, *A*, is maintained at a white heat by the burner, *B*. As soon as the compressed gases come in contact with the incandescent tube, an explosion takes place which hurls the piston back and causes it to perform work.

A STUDY OF ANGER.

THE manifestation of the feeling of anger is one of great importance for moral and physical education, but there has hitherto been upon it little literature worth reading. A paragraph in a text book, link-

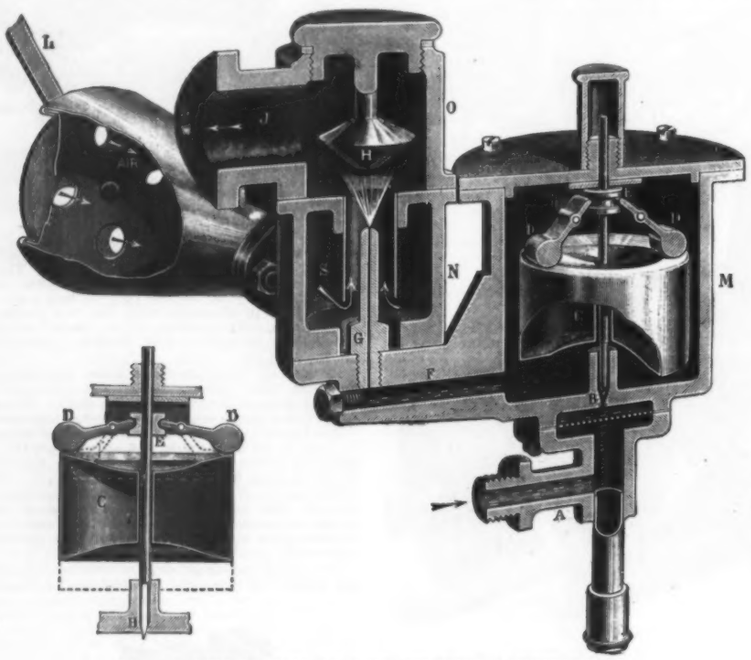


FIG. 11.—MECHANISM OF THE PHŒNIX CARBURETER.

ing it with the emotions of love and fear and hate, is generally all the notice it receives. In medical works it is regarded as a symptom of epilepsy and insanity, and a possible cause of other diseases, while novelists describe the passion of anger with a fine liberality of imagination, ranging all the way from the horrors and tortures of savagery and warfare to the climax of hatred and revenge in the murder of a Nancy or a Tito.

But anger as a daily universal experience, with a distinct physical reaction, has not been so widely studied. The child who screams and bites his nurse when carried off to bed, the schoolboy who fights another who sticks out his tongue at him, and the business man who damns an employee for stupidity, are all material for study, as well as the extreme cases that lead to crime or are the manifestations of paranoiac suspicion and rage.

That all anger is primarily a physical and secondarily a moral manifestation, is well shown by the very suggestive bit of work published by G. Stanley Hall in The Psychological Review, vol. 9, 1899. In "A Study of Anger," Mr. Hall has departed from the material of literary and world-famous pages, of which, however, he gives a very interesting review, and depends on original material which he has been collecting from reliable observers for several years.

The human tendency to rage seems greater the nearer man is to the savage and animal type, and the more he is obliged to struggle for his food. "Primitive man had no regularity of meals, working hours, or occupations, but days and weeks of idleness, alternated with, and prepared for, by periods of excessive strain in hunting and migration and warfare. Into such life rhythms, criminals and degenerates tend to lapse." On the other hand, the term "gentleman" is held by some to imply a command over one's passion of anger above all others.

In Mr. Hall's collection of experiences, coming from some two thousand cases, says The Medical Record, to which we are indebted, we find confessions of very trival causes of irritation and vexation. Some people have personal antipathies to certain physical characteristics in others, freckles, red hair, bad teeth, a peculiar laugh; while others feel decided aversion to personal habits, such as smoking, or eating in a slovenly way. Others are made furiously angry by being thwarted or denied their freedom, others by being slighted or gossiped about or contradicted. Jealousy, injustice, overwork, teasing, ridicule, mocking, provoke others to rage.

In all cases there were physical sensations accompanying the mental sense of anger, but these differed greatly with the individual. Eighty-seven per cent. describe flushing, and twenty-seven per cent. describe pallor as characteristic of anger. The heart bounds or beats rapidly, and several cases of death due to cardiac lesion are ascribed to anger. Some people have peculiar feelings in the throat and mouth, others become dizzy or faint; thirty-five per cent. of the cases report tears, and in twenty cases attacks called bilious are ascribed to anger. Salivation is generally more copious; the frequent swallowing of it probably causes the nausea which some mention as a concomitant of their anger; and blowing it in bubbles with a panting breath is undoubtedly the "frothing at the mouth" that is sometimes described. We agree with Mr. Hall that "it is a long cry to associate the salivation of anger with primitive anticipation of savory food," but when it comes to describing the abhorrence of spitting which is common in children and primitive people to a long experience of contagion of morbific germs through saliva, and saying that we have here "an instinctive prophylaxis against contagion," we feel that the conclusion is a little far-fetched.

The sounds indicative of anger are interesting, as passing from the monotonous cry of infancy, through the animal-like noises of childhood, to the threats and oaths of adult life. In many cases, paralysis of the throat is reported, and inability to speak above a whisper, or without crying or trembling, but in the greater number making a noise seems to be a natural expression of anger. The very close connection between intense muscular tension and loud phonation is shown in the characteristic cry of epilepsy, which resembles the battle cry of various savage tribes, while college yells at athletic contests are, according to Mr. Hall, "toned down cries of defiance."

The tendency to bump and butt with the head, so noticeable in childish fits of temper, he thinks, may be related to a previous phyletic experience, when early vertebrates, both aquatic and terrestrial, accumulated an ancestral experience of moving head first, breaking their way through water and obstacles.

Biting and scratching as a relic of animal hatred is common in childhood, and a strong jaw is considered a sign of force, compared to the weak, passionless character of a person with a weak jaw.

In general, temper decreases in the violence and frequency of its outbursts as the child approaches adolescence, but, if uncontrolled, develops into great irascibility with old age. The expansion of the mind and the reason, the work of the day, conscience and religion seem to tone down the violence with which the body seeks to relieve itself of its tension by giving vent to anger.

The study of reaction, and whether or not it is accompanied by humiliation, penitence, and atonement, is an interesting topic which the physical and moral healer could work out to advantage. The training of youth to self-control has hitherto been left to the individual mother and teacher, for discussion on the ethics of the upbringing of children generally degenerates into a sentimental dissertation on the rod. According to the temperament and environment of the child different means may be used to help him to self-control; a mirror to reflect facial contortions, a joke, the repetition of a text or prayer serve some by breaking for a moment the tension, while in over-indulged children Dr. Hall advocates "a vigorous application of Dr. Spankster's tonic," as working wondrous and sudden cures. Isolation from social intercourse helps; plain, unvarnished rebuke, the natural consequences of a tearing, smashing temper, and seeing the disagreeable effect of other ill-tempered children, are means often helpful to self-control, while some boys can work out their salvation only by a certain amount of fighting.

The state called irritability is due to loss of inhibition. Fatigue and loss of sleep are often responsible for it, and the irritability of convalescence is a sign that the lower reflexes are restored before the higher. Some forms of insanity consist essentially in the loss of this higher power of self-restraint; and not only anger but mania, acute and chronic melancholy, and suicide are thus explained. Good health, plenty of sleep, and removal of irritating causes, with occupation and amusement, seem to sum up the natural methods of cultivating self-control, without which crime and suffering are engendered.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Copper in Alaska: Notes From Dawson.—Deputy Consul Adams writes from Dawson City, February 28, 1900:

The Tanana district, just north by east of Prince William Sound, Alaska, is receiving considerable attention on account of the wonderful richness of its copper deposits. Prospectors report the finding of huge masses of nearly pure copper, from hundreds to thousands of pounds in weight, scattered over the country. A number of expeditions leave Dawson City next month for that district in the interests of companies already formed. The close proximity of this section to Prince William Sound and the local abundance of timber and water insure the most favorable conditions for its development.

Business in Dawson this season has been very quiet, without, however, any great change in prices.

The burned district is again covered with buildings, mostly of one story only, and not as substantial in character as those destroyed, which indicates that there is doubt in the minds of the property owners as to what will be the condition of business affairs next summer, after the exodus to Nome takes place.

Notwithstanding the difficulties and dangers attending a trip of from 1,200 to 1,400 miles over snow and ice in the most inclement season of the year, no less than 750 people left Dawson for Nome between December 4, 1899, and March 1, 1900, and thousands more are getting ready to leave in the spring by the first boats for the new El Dorado. Most encouraging reports have been received from Nome.

This winter has proven so far the coldest on record, ranging from 17° to 59° below zero.

The output for this season is estimated at from $20,000,000 to $25,000,000, or about double that of a year ago, which large increase is chiefly due to improved methods of working the mines.

Chinese vs American Cotton Goods.—Consul-General Goodnow writes from Shanghai, January 27, 1900, in regard to statements that he has seen in the United States newspapers relative to the magnitude of Oriental competition in the cotton manufacturing trade. The articles refer to a cotton mill at Hankau, in which, it is alleged, only Chinese labor is employed at wages averaging $1.75 per month. The mill has 34,000 spindles and 700 looms and makes good yarn. Other mills, it is said, are located in Shanghai. The real facts about cotton manufacturers in China, says Mr. Goodnow, are these:

The mill in Hankau has discontinued weaving cloth, as it could not meet the competition of foreign piece goods. The looms are being taken out and are being replaced by spindles. In Shanghai there are 750 looms running. It is claimed that these are now (but only very recently) making a coarse sheeting at a profit.

The cost of making this sheeting is fully as much as the manufacture of the same grade of cloth costs in America. Instead of wages averaging $1.75 per month, the cheapest coolie laborer receives $6 Mexican ($3 gold) per month; carders and spinners receive $25 to $30 Mexican ($12 to $15 gold) per month; engineers and weavers receive $20 to $60 Mexican ($10 to $30 gold) per month. Wages have risen very fast in the treaty ports, with the building of mills and the establishment of the foreign businesses, and are maintained at the higher level.

The labor, however, is less effective than the American labor. The American weavers accomplish two or three times, and American spinners at least four times, the results attained by corresponding Chinese workmen in the same time.

Two of the mills in Shanghai are now run entirely by Chinese, two have a foreign supervising engineer, and five have foreigners for the managers and heads of departments and supervisory places.

The yarn manufactured at this point and at Hankau goes to the province of Szechuan, and is there made into cloth on hand-looms in the villages and houses of the consumers. Only the coarse grades of cotton yarn are made, and the higher price of raw Chinese cotton, as the demand has increased, together with the competition of Indian and Japanese yarn, has caused these mills to run at a loss to the present time.

The cotton cloths dominating the market in Northern China and now challenging trade in Central China are from America.

We can control this market, adds Mr. Goodnow, so long as we have an equal entrance into all China, especially as freight lines from our country are multiplied; and when the Nicaragua Canal is built, no other American cotton goods need apply in China.

Railways in North China.—The following, dated Pekin, February 26, 1900, has been received from Minister Conger:

The Tientsin-Shanhaikuan-Niuchwang branch of the Chinese Imperial Railway is now completed and will soon be opened to general traffic. The distance from Tientsin to Niuchwang is 348·63 English miles. The line from Tientsin to Chinchow, 268·63 English miles, over which trains have been running for some months, is said to pay 14 per cent. on the whole capital invested. It is expected that when the entire line is open, the road will pay a return of 30 per cent.

The Chinese Eastern Railway (Russian), which is now completed from Port Arthur as far north as Moukden, connects with Niuchwang at Ta-shi-chiao, thence to

Port Arthur—distance 180 miles. Owing to the danger of running trains in China during the night, the time between Port Arthur and Pekin will be about three days.

The Russians are working with feverish activity to finish the road from Moukden to Vladivostock, and it is thought that Russia's two great strategic points in the Far East—Port Arthur and Vladivostock—where she is said to have garrisons variously estimated at from 120,000 to 200,000 men, will be connected by rail not later than August of this year.

Trains are now running over the Siberian Railway as far east as Stretensk, on the River Shilka, a tributary of the Amur, from which place the river route must be used to arrive at Khabarovsk, whence the Uszuri section of the railway runs to Vladivostock, thus completing for the present the great enterprise begun in 1891, and establishing uninterrupted steam communication between Western Europe, St. Petersburg, and the extreme eastern limits of the Russian Empire on the Pacific coast.

At present, the schedule running time is: St. Petersburg to Lake Baikal, nine days; Lake Baikal to Stretensk, three days; by river to Khabarovsk, six days; and to Vladivostock, one day; total, nineteen days.

The section of line between Stretensk and Vladivostock is now partly completed, and it is expected that the whole line will be open in about eighteen months.

Swiss Trade with the Soudan.—Consul-General DuBois, of St. Gall, under date of February 26, 1900, sends the following:

Switzerland for some time has had a successful export business with the Soudan, especially in watches and jewelry. The export business with Tripoli, which has suffered very much during the past year, now shows evidence of vigorous revival, as the caravans to the interior, going to Africa from Tripoli, will now be increased in number since the defeat of the rebels in the Soudan. Timepieces and jewelry to the amount of 1,379,150 francs ($275,830) were exported from Switzerland to the Soudan regions in 1897, and this was increased to $416,800 worth in 1898.

New Miners' Lamp in Germany.—Under date of February 26, 1900, Consul Hughes writes from Coburg:

Arthur Eitner, of Leipzig, has patented in this country a magnetic-locking arrangement for miners' lamps. He makes use of a horseshoe magnet with one pole cranked, so that, instead of lying in the same horizontal plane as the other, it occupies a rather higher position. When the lamp ring is brought under the cranked end corresponding to one pole of the magnet, a short vertical bolt is attracted so as to be drawn upward, and this leaves the locking bolt free, which latter is then drawn out horizontally by application of the other pole of the magnet.

New Method of Bleaching in Germany.—Consul Hughes, of Coburg, under date of March 7, 1900, says:

I wish to call attention to Prof. Koechlin's method for the bleaching of cotton and other vegetable fibers by passing them through a bath of 100 liters (26·4 gallons) of water, 10 kilogrammes (22 pound) of lime, and 50 kilogrammes (110 pounds) of bisulphite of soda. They are then steamed for an hour or two under a pressure of from 1 to 2 atmospheres, rinsed again, and dried. The bisulphite can be replaced by hydrosulphite of lime. The cotton or other fiber may be boiled in the bath for a few hours, instead of being steamed. Another process is to subject the goods for six hours under a pressure of two-thirds of an atmosphere to a liquid composed of 1,000 liters (264 gallons) of water, 10 kilogrammes of dry caustic soda, 10 kilogrammes of soap, 1 kilogramme (2·2 pounds) of calcined magnesia, and 30 liters (7·9 gallons) of peroxide of hydrogen; then rinse, souse, rinse again, and dry. The white obtained is said to be much better than can be had with hypochlorite, and, best of all, does no damage to the fibers or fabric.

Beet-Sugar Manufacture in Canada.—Commercial Agent Johnson writes from Stanbridge, March 17, 1900:

The establishment of a $500,000 factory for the manufacture of beet-root sugar in Canada will, it is said, be shortly undertaken by American capitalists, who are working with Messrs. J. E. Askwith and James Fowler, of Ottawa, in the interests of the enterprise. The factory will be located in Ontario, and will be capable of handling 500 tons of beets daily. The Canadian government is to be asked to place a bounty on the production of beet-sugar in Canada, and this, the promoters of the company claim, will insure the establishment in Canada of a great many other factories for making beet-sugar.

American Lard in Mainz.—Under date of March 6, 1900, Consul Schumann transmits the following:

The State penitentiary of this city, in advertising for bids for supplies, among other articles requests 2,200 pounds of lard, either German or American (white label brand). This is certainly very gratifying, taking into consideration that only a few years ago American lard was practically tabooed in this city and great efforts were made to prohibit its sale.

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No. 705. April 16.—New Method of Diminishing the Force of Waves and Surf—Hungary and the German Meat-Inspection Law—*Agricultural Implements in China—*American Lard in Mainz—*Beet-Sugar Manufacture in Canada.

No. 706. April 17.—The Russian Petroleum Trade.

No. 707. April 18.—Commerce of Hawaii in 1899—Trusts in Great Britain—Collection of Drafts in Cape Colony—American Boots and Shoes in Russia—Demand for Automobiles in Russia—Increase of Port Dues in Guadeloupe.

No. 708. April 19.—Licenses for Foreign Firms Doing Business in Russia—Copper in Alaska; Notes from Dawson—Chinese vs. American Cotton Goods—Cast Horseshoes in Germany—German Steel-Rail Exports—Commercial Conditions in Mexico.

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No. 710. April 21.—French System of Taxation.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

TRADE NOTES AND RECEIPTS.

Production of Artificial Slate.—This slate consists of a mixture of finely ground slate, lamp black and water glass solution, produced by mixing equal parts by weight of soluble potash glass and soda glass of 1·95 specific gravity. First the soluble glass solution is prepared by finely powdering equal parts (by weight) of solid potash water glass and soda water glass in a mortar, and pouring over this six to eight times the quantity of soft river water or, better, distilled water, whereupon the mass is boiled about 1½ hours, so that the water glass dissolves completely. Next, seven parts (by weight) of finely powdered slate, ground with water into an impalpable pap, and mixed with 1 part (by weight) of lampblack, and mixed as intimately as possible with the soluble glass solution, so that a rather stiff mass results, which may be put on with the brush. Same is applied on tin plates, roughened with sandstone.—Neueste Erfindungen und Erfahrungen.

Glazes for Cooking Vessels.—Serviceable glazes which conform to the legal requirements respecting the resistance of glazes containing lead, are produced in the following manner: Melt a frit of red lead, 22·9 parts (by weight); crystallized boracic acid, 31 parts; enamel soda, 42·4 parts; cooking salt 10 parts; gravel, 12 parts; feldspar 8 parts. According to the character of the clay, this frit is mixed with varying quantities of sand, feldspar and kaolin, in the following manner:

Frit	84	84	84	84
Red lead	1·5	1·5	1·5	1·5
Gravel	8	6	3	—
Feldspar	—	2	5	8
Kaolin, burnt	6·5	6·5	6·5	6·5

Glazes which are produced without addition of red lead to the frit, are prepared as follows. Melt a frit of the following composition: Red lead, 22·9 parts (by weight); boracic acid in crystals, 24·8 parts; enamel soda, 37·1 parts; calcined potash 6·9 parts; cooking salt, 10 parts; chalk, 10 parts; gravel, 12 parts; feldspar, 8 parts.

From the frit the following glazes are prepared:

Frit	86·5	86·5	86·5	86·5
Gravel	7	4·5	3	—
Feldspar	—	2·5	4	7
Kaolin burnt	6·5	6·5	6·5	6·5

—Sprechsaal.

Cheap Toilet Soaps.—It is probably little known that for a quicker saponification of soaps by the cold process, an addition of starch flour is of great value, especially for filled and colored soaps. If it is taken as a standard that 10 kilogrammes of starch flour are used per 100 kilogrammes of grease, the different proportions can be readily figured out by anybody. Every soapmaker knows that in the case of little coconut oil and much filling a separation easily sets in on stirring, which is entirely avoided by adding starch flour. Care has to be taken, however, that the starch flour is quite dry and the temperature of the oil not above 25 to 30 degrees Réaumur. The starch flour is stirred in coco oil and added through a hair sieve to the stirring kettle.

Following are some mixtures taken from practice:

Yellow.— Ceylon coconut oil 25° R. 25 kilogrammes, starch flour, 26° R. 2½ kilogrammes; soda lye of 38° Baumé, 13 kilogrammes; sugar filling of 25° B. (cold; consisting of sugar, water, and potash) 15 kilogrammes; wax yellow No. 8, 10 grammes, citronella oil, 100 grammes.

Red.— Ceylon coconut oil, 25° R., 25 kilogrammes; starch flour, 25° R., 2½ kilogrammes soda lye of 38° B., 13 kilogrammes; salt water, 10° B., 20° R, 5 kilogrammes; water glass of 36° B., 20° R, 7½ kilogrammes; soda lye of 38° B., 20° R., ½ kilogramme, fine pink color, No 115, 15 grammes; palmarosa oil, 150 grammes.

Brown.—Ceylon coconut oil 25° R, 25 kilogrammes; starch flour, 25° R., 1½ kilogrammes soda lye of 38° B., 13 kilogrammes; windsore brown, 25 grammes; cassia oil 50 grammes; clove oil, 10 grammes; Peru balsam, 25 grammes; wintergreen oil, 15 grammes; water glass 12½ kilogrammes. The frames must be well covered up for 12 hours. It is self-understood that anyone may choose filling, perfume and color, as desired.—Drogisten Zeitung.

Assaying of Gold.—To determine the presence of gold in ores, etc., mix a small quantity of the finely powdered ore, say 120 grammes, in a flask with an equal volume of tincture of iodine, shake repeatedly and well, and leave in contact about one hour, with repeated shaking. Next allow the mixture to deposit and dip a narrow strip of filtering paper into the solution, allow the paper to absorb, next to dry and dip it again into the solution, repeating this five to six times, so that the filtering paper is well saturated and impregnated. Now the strip is calcined, as it were, and the ashes, if gold was present, show a purple color. The coloring disappears immediately if the ashes are moistened with bromine water. The same test may also be modified as follows: Cover 120 grammes of the finely pulverized ore with bromine water, shake well and repeatedly during about one hour of the contact, and filter. Now add to the solution stannic protochloride in solution, whereby in case gold is present a purple color (gold-purple of cassius) will at once appear.

In case the ore to be assayed should contain sulphides, it is well to roast the ore previously, and should it contain lime carbonate, it is advisable to calcine the ore before in the presence of ammonium carbonate.—Die Edelmetall Industrie.

Luster Colors.—In order to produce luster colors with various reflexes by the aid of gloss-gold, the gloss-gold is mixed with varying quantities of bismuth flux, prepared by grinding together 12 parts (by weight) of bismuth nitrate and 1 part of borax glass powder. Golden reflexes are obtained by mixing 10 parts (by weight) of gloss-gold, with 2 parts of bismuth flux; rose colored reflexes, by 4 parts (by weight) of gloss-gold, with 2 parts of bismuth flux; blueish violet ones by 2 parts (by weight) of gloss-gold and 4 parts of bismuth flux; pale blue reflexes by 2 parts (by weight) of gloss-gold and 8 parts of bismuth flux. By adding to the last mentioned mixture the otherwise yellow-dyeing uranium luster color, shades from bluish-gray to yellowish-green can be obtained.—Sprechsaal.

SELECTED FORMULÆ.

For Polishing Cover Glasses.—There is, says Mr. F. W. Cooper, in The Photogram, nothing better than a piece of chamois leather or velveteen stretched over a board (2 feet by 5 inches by ¾ inch) and tacked to the under side, a piece of stout twill being interposed between the board and the velvet. The glasses having been cleaned and merely drained, can be very quickly and perfectly polished by rubbing up and down the leather or velvet surface. The board has the advantage of obviating any risk of cutting the hands or breaking the glasses as when polishing is done with a duster and the glass held in the hand.

An Opaque Screen.—M. Molteni, in Helois, gives the following instructions for making an opaque screen: Prepare a mixture of gum arabic (1 part), powdered magnesia (4 parts), and water (80 parts). In this, soak your cotton or linen sheet. On drying it has a matt and very reflecting surface. In place of magnesia, whiting can be used. If the screen is to be a fixture, all that is necessary is to stretch it on a wooden frame. If it is to be rolled, the upper edge must be nailed to a stout roller, and the lower to a heavy curtain rod. The mixture for the roller screen should contain a little glycerine to give the fabric the necessary suppleness and to prevent the pigment scaling off when the screen is rolled and unrolled.

Cleaning Tracings.—The American Machinist and The Engineering Record recently gave two kinks of value to draughtsmen relative to cleaning tracings and restoring the glaze. A correspondent to the latter journal says:

Very few engineers or draughtsmen seem to know that tracing cloth can be very quickly and easily cleaned, and pencil marks removed by the use of benzine, which is applied to a cotton swab. It may be rubbed freely over the tracing without injury to lines drawn in ink, or even in water color, but the pencil marks and dirt will quickly disappear. The benzine evaporates almost immediately, leaving the tracing unharmed. It must, however, be borne in mind, that the surface has been softened, and must be rubbed down with talc, or some similar substance, before drawing any more ink lines.

The American Machinist states that the chief draughtsman of the Rushmore Dynamo Works, in Jersey City, has discovered that the glaze may be restored to tracing cloth after using the eraser by rubbing over the roughened surface with a piece of hard wax from an old phonograph cylinder. The surface thus produced is superior to that of the original glaze, as it is absolutely oil and waterproof.

In the Rushmore works all pencil drawings that go into the shop are first rubbed over with this wax, and it has been found that while common pencil drawings are soon destroyed by dirt and grease, those treated with the wax return to the drawing room after the completion of special jobs without the slightest blemish.

White Wash —

1. Lime, clean and well burnt ..... 6 quarts.
   Spanish whiting, or powdered burnt alum ..... 4 ounces.
   White sugar ..... 16 "
   Rice flour ..... 3 pints.
   Glue of good quality ..... 16 ounces.
   Water, boiling ..... 5 gallons.

Slake the lime in a vessel of about 10 gallons capacity, with hot water, keeping the vessel covered to retain the steam, and pass through a sieve to clear of coarse particles. Make up the rice flour to a thick paste and boil well, and dissolve the glue in water over a water-bath; then mix the liquids with the remainder of the water, and add the whiting, glue and the sugar. The mixture should be applied warm on outdoor surfaces, and cold indoors.

2. Another formula said to be used by the United States government in making white wash for lighthouses and some other public buildings, is as follows:

   Unslacked lime ..... 2 pecks.
   Common salt ..... 1 peck.
   Rice flour ..... 3 pounds.
   Spanish whiting ..... ½ pound.
   Glue (clean and white) ..... 1 "
   Water, a sufficient quantity

Slake the lime with sufficient boiling water to thoroughly cover it, strain, and add the salt previously dissolved in warm water. Boil the rice flour in water; soak the glue in water and dissolve on water bath, and add both, together with the whiting and five gallons of hot water, to the mixture, stirring all well together.

Cover to protect from dirt, and let it stand for a few days, when it will be ready for use.

It is to be applied hot, and for that reason should be used from a kettle over a portable furnace.—Druggists' Circular.

Artificial Mineral Waters.—

1. Magnesium sulphate ..... 9600 grains.
   Potassium sulphate ..... 50 "
   Sodium sulphate ..... 9000 "
   Sodium chloride ..... 780 "
   Sodium carbonate ..... 50 "
   Calcium carbonate ..... 55 "
   Mix intimately by trituration, and dissolve in
   Pure water (gradually added) ..... 10 gallons.
   Filter and charge to 100 pounds pressure.
2. Potassium sulphate ..... 80 grains.
   Sodium sulphate ..... 3720 "
   Magnesium sulphate ..... 3162 "
   Calcium sulphate ..... 800 "
   Sodium chloride ..... 4888 "
   Magnesium chloride ..... 2400 "
   Magnesium carbonate ..... 240 "
   Calcium carbonate ..... 9 "
   Magnesium bromide ..... 70 "
   Mix intimately by trituration and dissolve in
   Pure water ..... 10 gallons.
   Filter and charge to 100 pounds pressure.
3. Sodium chloride ..... 7¾ ounces.
   Sodium bicarbonate ..... 2 "
   Magnesium sulphate ..... 2 "
   Potassium chloride ..... 160 grains.
   Water, enough to make ..... 10 gallons.
   Mix and charge in the usual manner.

—Pharmaceutical Era.

FOG SIGNAL DETONATOR ECONOMIZER.

NOTWITHSTANDING all the efforts of inventors to supplant the old-fashioned system of fog signaling, the fogman and detonator still prevail. Neither, it must be admitted, is infallible, but the combination, generally speaking, has answered requirements. One of the greatest drawbacks urged against the system is the almost general use of two detonators to produce one explosion. The reason for this is that one detonator is liable to fail, owing to the wheel of the engine skidding and pushing it off the rail, in which case a driver depending upon an explosive signal, if blocked, would assume that the line was clear, and allow his train to proceed. If one of these detonators can be saved without detracting in any way from the efficiency of the system it will be seen that on busy lines during foggy weather a considerable economy will be effected. A simple and inexpensive appliance is now being made use of on the Great Eastern Railway, whereby the safety of the double-explosion system is maintained without the corresponding necessary expense of always using the second detonator. This apparatus is illustrated herewith. Its essential function is the utilization of the force produced by the explosion of the first detonator to withdraw the second one from the rail before the wheel passes over it. A^1 and A^2 are two bearings, fixed in adjacent sleepers, at a point where the fogman is stationed, and constitute the bearings of the bar, *B*. *C* is the first detonator in the path of the engine, placed in the usual manner by hand on the top of the rail. This detonator is fixed to the rail by the usual lead clip, and is intended to be exploded. *D* is an impact disk fixed on the rod, *B*. *E* is the second detonator clipped on a tin-plate, *F*, which is swiveled on an attachment, *G*. When the detonator, *C*, is exploded, the sudden expansion of the gases thus caused throws back the plate, *D*, and causing the rod, *B*, to revolve, the tin-plate, *F*, and with it the second detonator, is withdrawn from the rail before the wheel passes over it. This apparatus, says The London Engineer, is manufactured by the Railroad Signal Company, Limited, Fazakerley, Liverpool.

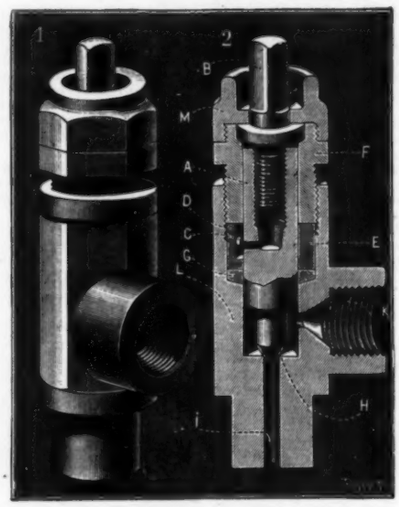
FOG SIGNAL APPARATUS.

NEW BORING MACHINE.

THE illustration herewith shows a double-ended ingot boring machine. This is capable of boring ingots up to 12 feet long, and 5 feet 6 inches over the corners, from both ends simultaneously, or from either end separately, as required. The maximum diameter of trepanning bar the machine will take in is to bore a hole 16 inches diameter. The foundation bed is 44 feet long, with the upper surface planed with ⊥ bolt slots the full length, to receive the two top beds carrying the boring headstocks and guide pedestals for supporting the outer ends of the trepanning bars. Each boring headstock has a worm and wormwheel motion, with three sets of changeable spur gearing to suit the diameter of the holes to be bored. The machine is driven by fast and loose pulley or by electric motor, as desired, with a clutch to stop or start each boring head, to work them either together or separately. The boring headstocks are traversed in the bed with self-acting feed by two steel screws geared together; also with quick withdrawing motion by open and cross belts, to withdraw the bars in or out of the hole rapidly. The wide central part of the foundation bed carries two strong V blocks, each with three strong setting-up screws for adjusting the ingot, and made with horns to fasten the lashing chains by which the ingots are held in position. The trepanning bars are made fitted with steel cutter heads, and steel tools are inserted for trepanning; also a boring head to take the place of the trepanning head with four knife tools to face up the ends of the ingot before starting trepanning. The driving end of each bar is made with a face plate coupling to bolt to the coupling on each driving headstock. The bars are turned, bored, and fluted, to give the necessary clearance for the cuttings. The weight of the finished machine is forty-six tons. Machines of this type have been supplied by Craven Brothers, Manchester, Eng., and are in successful operation.—The Engineer.

A NEW STOPCOCK FOR COMPRESSED AIR RESERVOIRS.

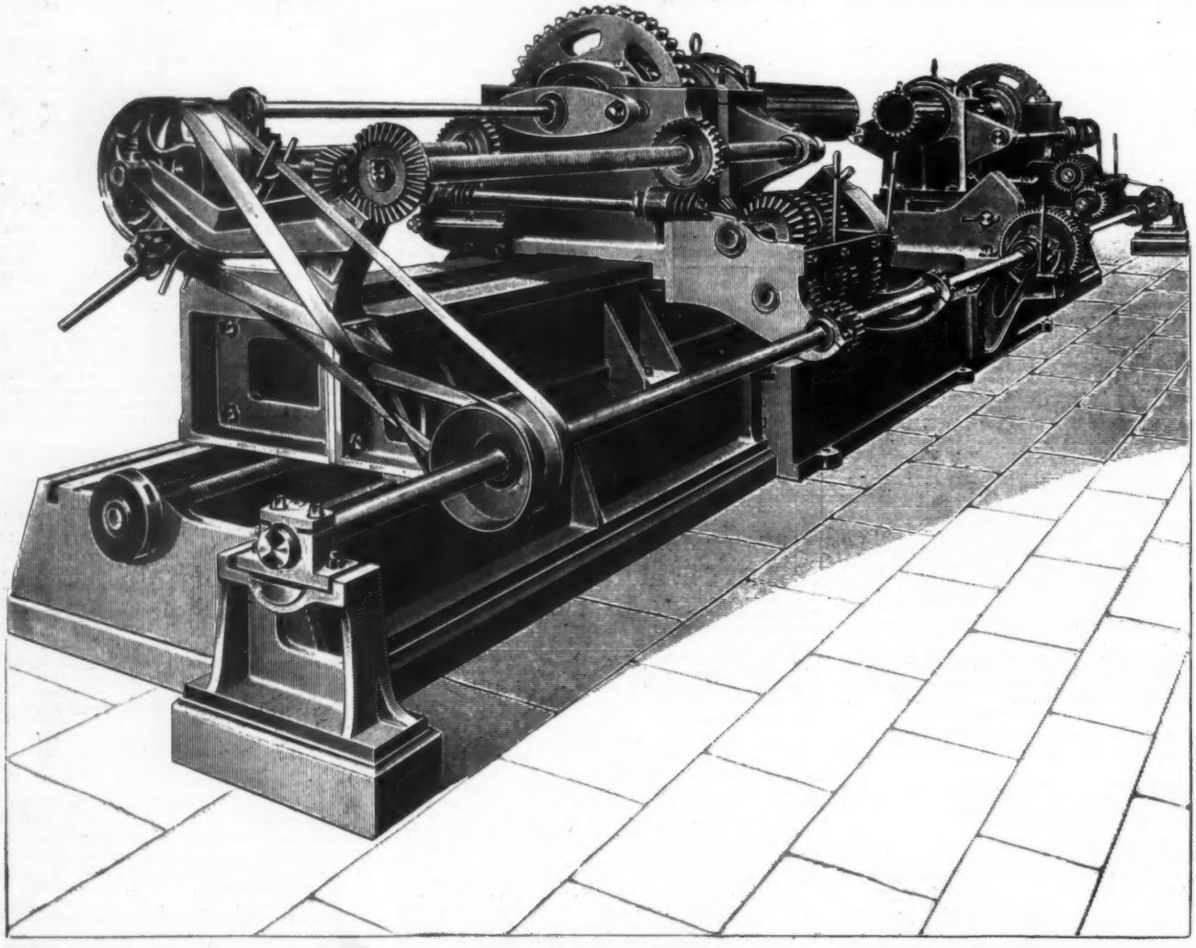
WE illustrate herewith a new stopcock applicable to all those cylinders which are used so extensively now-a-days for the storing up and transportation of compressed gases. Let us, in a word, recall the fact that in ordinary cocks of this kind we find a pointed plug made of steel (and consequently oxidizable) and forming part of the controlling screw, which forces it to revolve during its ascent, and descent. In the cock under consideration, the plug is of German silver and independent of the maneuvering screw, which merely communicates to it, a sliding motion in the direction of its axis. perfect tightness is obtained by means of a guide ring that bears constantly against a leather washer. This arrangement may be at once understood by a reference to the figure which shows a longitudinal section of the cock, and beside it an external view of the whole.



STOPCOCK FOR COMPRESSED AIR CYLINDERS.

The plug is moved by means of the square head of the screw, *B*, through the action of a key of the ordinary type. It is prevented from revolving and is guided in its upward and downward motion by a small set screw, *C*, which forms a spur and is easily put in place before screwing together the two parts that form a box for the maneuvering screw. The screw, *C*, engages in the groove, *D*, with which the ring, *E*, is provided. This latter is set into the body of the cock and is locked firmly in place by the upper half, *F*, of the two parts that form the box for the screw. This exerts a pressure upon the washer, *G*, which prevents any leakage from taking place after the point of the plug has left its seat, *H*.

When the screw, *B*, is revolved from right to left, the plug will rise, and the fluid compressed in the reservoir



INGOT BORING MACHINE.

will escape through the conduits, *I* and *K*, without oxidizing the German silver of the end of the plug which it encounters during its passage. It would be impossible for it to take any other direction than that of *K*, as there is no chance of leakage, in consequence of the adequate pressure that is exerted upon the rubber washer by turning the screw collar, *F*.

For the foregoing description and the engraving we are indebted to La Nature.

THE DE BANGE AND PIFFARD RAPID-FIRE GUN.

THE new De Bange and Piffard rapid-fire gun possesses certain original features, and is distinguished from other field pieces by the peculiar arrangement of the breech closure and the manner in which the recoil takes place.

The gun, which is of steel, is of 3-inch caliber and weighs 748 pounds. It consists of a tube, reinforced by a jacket carrying a trunnion sleeve and presenting at the rear a lodgment for the breech screw. The latter is, as usual, provided with interrupted threads, but, instead of being cylindrical or in the form of a truncated cone, is ogival. As the center of the directing ring of the ogive is on the axis of rotation of the obturator, the disengagment of the screw is effected without the necessity of withdrawing it longitudinally, a single motion of the actuating lever causing it to swing back clear of the breech. By acting upon this lever, the screw is first turned the eighth of a revolution necessary to unlock it; and then the action continuing, the screw swings back and the breech is opened. It is during this second action that the extractor comes into play and throws out the empty cartridge case.

The firing pin is cocked automatically at the moment of the opening of the breech. The arrangement of the trigger is such that is rendered immovable as long as the breech is not entirely closed, and so no premature firing is to be feared.

The carriage weighs 1,144 pounds. Of the parts that rest upon the ground, the stock and wheels, the former is rendered immovable by a spade, and the latter by block brakes or skids. The gun rests through its trunnions, upon a bronze cradle. When the recoil occurs, the piece and its cradle slide upon the cheeks. The extent of the recoil is limited by a brake. In order to prevent the rising that would tend to occur in a fire at small angles, the surface upon which the sliding takes place is curvilinear, the result being that the movable part exerts at every moment a pressure that prevents the rising of the carriage. Through such an arrangement of the slides, the gun and its cradle are lifted, and when the recoil has terminated, tend to resume their first position under the action of gravity. It follows from this that it is not necessary to have a system of recuperators, as in the majority of field guns. The firing brake may be either a hydraulic or friction one, as may be desired. These two brakes have a circular form. In the hydraulic one, the recoil causes the rotation of a drum filled with liquid in which is placed a stationary piece that forms a resistance to the displacement of the liquid. In the friction brake, the friction is produced by two grooved plates that are pressed against each other by Belleville springs.

The vertical pointing of the gun is obtained by means of a toothed arc, which is supported by a cradle and actuated by hand-wheel fixed upon the stock. The pointing in direction, when the spade is buried in the earth, is easily rectified by the displacement of the axle in the box that serves as a cross-brace to the cheeks.

The ammunition chests are so arranged as to have the effect of preventing the distortion of the cartridges, and of allowing the piece to be easily supplied. The cartridges are suspended therein vertically and can be brought one after another opposite the lid of the chest. The cartridge supports are carried by springs designed to reduce the shocks that are likely to occur during carriage. There are thirty-six cartridges in the chest of the fore-carriage and sixty in that of the after-carriage.

The weight of the charge is 23 ounces of powder. The projectile weighs 14 pounds and has an initial velocity of 1,738 feet.

The experiments made with this gun have given very satisfactory results from the standpoint of accuracy and rapidity of fire.—La Nature.

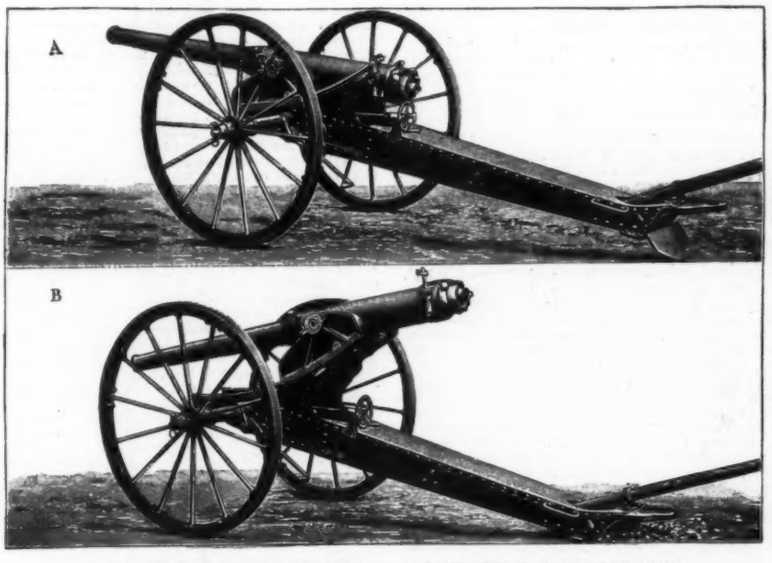


FIG. 1.—THE NEW DE BANGE AND PIFFARD RAPID-FIRE GUN.

GOVERNMENT TELEGRAPHY.

W. S. HARWOOD describes in the April Century the successful working of the government telegraph in Great Britain.

Since the British government, in the year 1870, assumed control of all inland telegrams, the business of that department of the general post office has grown to enormous proportions. The object of assuming this control was twofold: first, to reduce the exorbitant telegraph tolls of private companies—tolls so high as virtually to be prohibitive for many kinds of business; and, secondly, to safeguard the public against any return to former charges. It matters not what one may think as to the desirability of the introduction of such

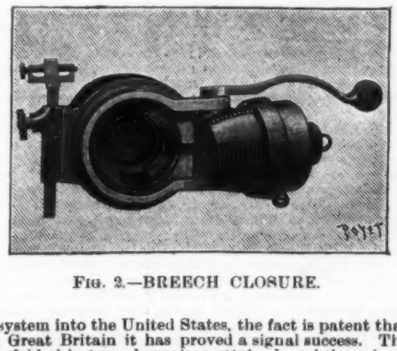


FIG. 2.—BREECH CLOSURE.

a system into the United States, the fact is patent that in Great Britain it has proved a signal success. The twofold object was long since attained, and there is no likelihood that the system will be overthrown. . . . .

The report of the post office department for 1899 gives the latest available figures. This report shows that the people so far appreciate and utilize the system that they sent in 1899, up to the date of the closing of the report, in ordinary telegrams, which are exclusive of press telegrams, cable messages, government, franked, and reduced rate dispatches, over three million messages more than during 1898. In 1869, the year before the government assumption, seven million messages were sent; in 1899, nearly ninety million messages. In 1869, the average charge for telegrams was a little over fifty cents, while the charge for the same message to-day, inclusive of address, is about fifteen cents. In 1869, there were under three hundred employees, while there are at present over three thousand in the London office alone. Last year, after allowing for a deficit of at least a million dollars in the department devoted to the daily newspapers, the system cleared above all cost of maintenance over one hundred and sixty-five thousand pounds; in round numbers, eight hundred and fifty thousand dollars.

THE LABOR OF DISCOVERING A NEW ELEMENT.

WHAT it means to discover a new chemical element in these days of minute and laborious physical investigation may be seen from the following description, given by The Imperial Institute Journal (London), of the methods used by Sir William Crookes in bringing to light the substance announced by him last year and then called monium, but since named by him Victorium, in honor of England's Queen. Says this paper:

"The method by which this latest discovery has been made affords an excellent example of the possibilities of modern research, especially in the hands of a man who commands the resources of more than one branch of science, and is able to employ the highest powers of each alternately as need arises. In addition to the chemical operations requiring the highest judgment and much manipulative skill, which were employed to isolate the substance, its identification and investigation were only possible by the application of physical methods still more complicated in their nature. The almost pure element had to be inclosed in a vacuous bulb and submitted to molecular bombardment from the negative pole of an induction coil in the manner now familiar by the frequent exhibition of the X-ray bulb. The phosphorescent glow thus obtained was examined through a specially designed spectroscope of extreme power and precision, whose results were recorded by a photographic plate, the rays of special interest being in the ultra-violet part of the spectrum, and, therefore, invisible to the naked eye. For the examination of the negative so obtained a machine capable of measuring directly to the hundredth thousandth of an inch was specially constructed and applied. The pure substance itself was not used in the final investigations, the anhydrous sulfate being employed as obtained by heating the earth with strong sulfuric acid and driving off the excess of acid at red heat. For an account of the more distinctive chemical properties of the new element, the wave lengths of its distinctive rays when in a phosphorescent condition, and a detailed description of the two-prism spectrograph, reference must be made to the original paper in the Royal Society's proceedings. The diagram attached to the paper exhibits the process of fractional separation, and indicates that nearly one thousand distinct operations were necessary before the element was obtained in a comparatively pure condition."

THE USE AND ABUSE OF FOOD PRESERVATIVES.*

By SAMUEL RIDEAL, D.Sc. Lond., F.I.C.

THE subject of food preservatives does not seem to have been formally before the society since the Cantor lectures of Dr. Benjamin Richardson in 1878, and the paper by F. Barff in 1882, dealing mainly with "boroglyceride." Food preservation, however, for a long time formed a rather important department of the society's work. A special Food Committee sat from the beginning of 1867 until the early part of 1879 to investigate the various methods proposed for the preservation of food. According to information furnished me by the secretary of the society, this committee examined a very large number of specimens and tested a great variety of processes, some of which were favorably commented upon at the time; but the general outcome of its work rather tended to show that none of the methods proposed, other than those of canning and refrigerating, were successful. With regard to the latter, it was only at the end of 1869 that this process appears to have attracted much attention from the committee, and the opinion then formed was that the proposal was theoretically excellent, but that the mechanical arrangements in use at that time were not sufficiently perfected to enable the method to be carried out successfully.

Now, that a departmental committee is appointed "to inquire into the use of preservatives and coloring matters in food, and to report (1) whether the use of such materials, or any of them. . . in certain quantities, is injurious to health, and if so, in what proportions does their use become injurious; (2) to what extent and in what amount they are so used at the present time," a short history of their use may afford a fitting introduction to a discussion on the subject.

It was early found that perishable solid foods could be rendered more portable and preserved for considerable periods by simple drying. In hot countries hanging in the sun was usually sufficient; in colder ones artificial heat had to be employed. The first taste for smoked provisions probably arose from the practice of suspending the meat or fish near the roof where they were penetrated by the vapors from the peat or wood smoke, which greatly increased the keeping properties. The South American "charqui," North American "pemmican," South African "biltong," and the meat dried, pounded and mixed with fat, which was formerly much used in Arctic voyages, are well known. Raisins, figs, various herbs, and notably hay, are very early examples of drying applied to vegetable products.

Probably the first discovery of the preservative use of salt was accidental, and due to the finding of carcasses embedded in the incrustations of the many saline deserts of Asia. Pliny describes salt as "defuncta etiam à putrescendo vindicans, ut durent ita per secula" (Hist. Nat. xxxiii., 9), and refers to "carnes sale adservatæ," flesh preserved with salt (ibid, xxxiii., 10.) Columella (de Re Rustica) has "muriâ condire," to preserve with brine. But at periods when fresh food was easily obtained, preservation was not so much a matter of importance, and, therefore, there are few early allusions to the use of salt, vinegar, and allied substances except as medicines or condiments.

The difference between various salts was confused, and the names given are difficult to identify. Thus in Jeremiah ii, 22, and in Pliny, niter signifies crude carbonate of soda, since called natron, and later in Spain barilla, and although the real niter or saltpeter was collected in India before the Christian era, the beginning of its use for reddening salted meats I have not been able to trace.

The Greeks and Romans made great use of salted fish, but mainly as an incentive to the consumption of wine. It was not likely that salting would be employed popularly, since salt was by no means plentiful, as shown by the word "salary" (salarium), or allowance of salt, coming to mean the payment of officials (Trench). Wine was frequently salted, or made with sea-water, with the object of keeping. Olives, samphire, and other vegetables were preserved in brine. Pickles of various kinds, *ταρίχη*, were used (Julius Pollux, book vi.).

Alum was known to the Egyptians as a drug, and its astringent and preservative action on flesh is mentioned. The effects of sulphur in fumigation are described by Homer.

Boric acid and borax were confused by the ancients with other salts, and valued only as fluxes in the arts. Asiatic borax was first refined at Venice. Boric acid was named by the alchemists "sal sedativus," but without reference to its preservative effect.

Aromatics, on the other hand, from being used for embalming, were eventually extended to food. These generally owed their properties to benzoic or cinnamic acid or to essential oils. Turpentine from Pistacia

* Paper read on March 21, 1900, at the meeting of the Society of Arts, London, and published in the Journal of the Society.

terebinthus (not from pines) was added to wine in Palestine, and is several times mentioned in the Bible. Among the Romans, myrrh, the gum-resin of Balsamodendron myrrha, which grew throughout the East, had a great reputation for preventing the souring of wine. Pliny (Hist. Nat., xiv, 13), says :—"Lautissima apud priscos vina erant, murræ odore condita." Essential oils, aloes and other bitters were also used (ibid, xiii, 15 ; Palladius, xi, 14).

Bitter herbs were used from the first, and owed their virtues in preventing change partly to their tannin, which coagulated albuminous substances, and partly to essential oils and to alkaloids, which acted as antiseptics. Mugwort (Artemisia vulgaris), alecost (Chrysanthemum balsamita) and alehoof (Nepeta glechoma), derived their Saxon names from their preserving beer ; wormwood (A. absynthium) was much used for vegetable juices on the continent. Camomile, quassia, gentian, and hop are all bitters of the kind. Acrid substances like pepper were early employed as preservatives, particularly from insects. All these imparted their own strong flavor, and, therefore, their application was limited.

In northern climates the smoking of meats and fish was always practised, and oak or beechwood smoke was preferred, as these yield more of the preserving agents, acetic acid and creosote. The formation of an "empyreuma," or tarry liquor, from wood was early known, and to hasten the process the flesh was dipped in it before smoking, but in this way an inferior product was obtained.

Glauber, in 1650, mentions the preservative power of wood-tar, or "the oily part of the distillation of wood, which is more fixed than the acid," and states that if meat is either simply washed, dried and laid in strong vinegar, or boiled in a weaker vinegar and set aside in a cool place, it will often keep for several months, and that meat will keep fresh for a considerable time if suspended in a close vessel, on the bottom of which some strong acetic acid has been poured. Fish was "soused," or pickled in vinegar and spices in very ancient times.

Although strong spirit was distilled from fermented juices by several ancient nations, it does not seem to have been applied to preserving solid foods, probably on account of its hardening properties. Even at present, "cherry brandy" is about its only well-known use in this direction, but for vegetable juices, as cordials, spirit was largely employed, usually with spices.

Oil was used at a very early date for preserving fish and for covering wine, and had mainly the object of excluding air. Both uses are still extant, for wine in Italy, and in tinned sardines.

Not only fruits, but meat and fish have been kept by sugar alone. In Portugal, fish are still preserved by splitting, cleaning, and sprinkling the interior with sugar, and laying out horizontally so that the sugar may penetrate as much as possible. It is said that fish prepared in this way can be kept for a long time with a perfectly fresh flavor, especially salmon, and that one or two ounces of powdered white sugar is sufficient for a 5-pound fish.

SALTING.

The only inorganic salt that we intentionally and habitually add to our food is sodium chloride, which seems to be very necessary for digestion and a natural instinct, as many wild animals are noticed to regularly visit salt deposits, and will lick lumps of salt. It will be noticed that these natural deposits always contain nitrates, and in many cases borax.

There seems to be no direct equivalent of our word "bacon" in the classics. "Perna" (Plautus, Curc., ii, 3, 54; Persius, "et piper et pernæ, Marsi monumenta clientis"), "petasio" and "laridum" or "lardum," seem to be the nearest. The wore "bacon" is old French.

Salting, as commercially practised, is a process of osmosis or diffusion ; a crystalloid applied externally, either as a solid or in strong solution, diffuses into the interior, while the soluble albuminous matters pass out into the brine. Soluble mineral salts, and sugar, also act as partial desiccators by their affinity for water. The flesh is deprived of a great part of its putrescent constituents, but at the same time loses a corresponding nutritive value (Liebig estimated the loss at one-third to one-half) and leaves nearly insoluble fibrinoids, partially hardened and less digestible, "induratus sale," as Pliny says (Hist. Nat., xxviii, 20).

After either smoking, salting, or drying, the characters of fresh food cannot be restored. It was not till the middle of the 19th century that it was discovered that small quantities of certain antiseptics would enable the original qualities to be retained, and prevent decay for a considerable period, with less influence on digestion than the old curing processes.

The quantity of mineral matter introduced in salting is considerable. A mixture of 2 pounds salt, 2 ounces saltpeter, and 1½ ounce moist sugar is rubbed thoroughly into the meat, which is then kept in a cool place and turned daily, rubbing in fresh salt where required. When the brine, as it forms, is drained away from the meat, the process is called dry-salting ; if it be allowed to remain on it, it is called wet-salting or pickling. A pickling brine is made with 4 pounds of salt, ½ pound to 1 pound sugar, and 2 ounces saltpeter in 2 gallons of water. The liquor, in time, becomes diluted by the meat juices, and is also apt to turn foul, therefore, at intervals, it is boiled down with more of the dry ingredients and skimmed, which has the effect of sterilizing it, and removing albuminous matters. For a fine red color the saltpeter is increased to about 8 per cent. of the pickling salt. In America it is usual to add to the brine about one-half per cent. of bicarbonate of potash or "saleratus" and creosote sometimes in the proportion of one drop to the gallon.

In this way a high amount of salt, and an appreciable quantity of niter is consumed with the food. Thus, in mild cured bacon, I have found the following percentages :

	Sodium chloride.	Potassium nitrate.
Raw	4·27	0·0083
Smoked	3·34	0·0086
Smoked and boiled	2·38	0·0065
Smoked and grilled	2·24	0·0086

The antiseptic power of salt is decidedly weak, hence the need for large quantities. Pringle, who was one of the first to introduce direct experimental methods in the study of disinfectants, in his "Mémoire sur les Substances Septiques et Antiseptiques" (Acad. des Sciences, 1750), which is of classical interest, found sodium chloride so weak an antiseptic that he placed it the lowest in his scale of bodies investigated. In further experiments he proves that salt more commonly hastens putrefaction ; for in the proportion of 10 to 20 grains to 2 grains of beef and 2 ounces of water, the salt softens and dissolves the meat, and "by a septic virtue favors its digestion." He cites other authors who admitted the "putrefiant" nature of sodium chloride. In many cases brine becomes contaminated with ptomaines. The meat, however, is usually washed before cooking.

Occasionally carbolic acid or phenol has been added to brine ; but it is an objectionable antiseptic for food on account of its odor, taste and poisonous character. Carbolic paper has, however, been much used in Europe for packing meats ; it is made by mixing 5 parts of paraffin wax, 5 of stearin, and 2 of phenol, and brushing in a melted state over paper.

PRESERVING FOOD BY GASES.

About fifty years ago, Pelouze, from the observation that carbon monoxide was absorbed by hæmoglobin, forming a compound that was hardly putrescible, devised his process for the use of this gas as a preservative.

The meat was cut up into pieces of convenient size, and placed in an atmosphere of carbon monoxide, under pressure. It was then dried in a current of air, and sealed up air-tight, or might be kept in a solution of salt or saltpeter, or in "much diluted carbolic acid."

Carbon dioxide, CO_2, seems to have a special antiseptic action, as Slater* found that this gas in mineral waters has a remarkable effect in killing pathogenic bacteria (typhoid, cholera, Staph. pyogenes aureus, Finkler-Prior bacillus), and Hochstetter found the same in the case of typhoid, cholera, rabbit septicæmia, Micrococcus tetragenus, Finkler-Prior bacillus, Aspergillus flavescens (a yellow mold), and anthrax bacilli, but not anthrax spores.

It is well known that fermented liquors preserved in bottles remain stable for long periods, and this stability seems difficult to explain by the self exhaustion or deposition of all the bacteria present. Bethell, in 1848, patented a process for preserving milk, which consisted in first boiling the milk to expel all the air contained in it, and then saturating with carbon dioxide ; when so treated, the liquid remains fresh for a long time after being opened. More recently compressed oxygen and sterilized air have been tried for preserving milk. Butter, when kept in carbonic acid, at a pressure of six atmospheres, often remains unchanged for four or five weeks.

In May, 1898, I examined a leg of mutton that had been preserved raw in CO_2 since December 2, 1897. Although it had lost some of its color and had softened it had no offensive odor. When either stewed or roasted it was quite palatable and produced no ill effects. The fat was normal and the cold water extract differed slightly from that of fresh meat, but the broth was much less savory. The minced flesh when kept for four days simply dried up and became covered with mold, but did acquire a putrid odor as fresh meat did. Comparative analyses gave (fat excluded) :

	Preserved leg.	Fresh mutton.
Water	71·53	75·19
Soluble albumin and globulins	0·86	2·49
Soluble inorganic salts	1·12	0·95
Insoluble ditto	0·32	0·28
Organic extractives :—Albumoses, peptones, and flesh bases	5·44	3·40
Gelatinous matters extracted by water under pressure for six hours at 115° C.	2·69	2·26
	100·00	100·00
Total cold water extract	7·42	6·84
Total ash	1·44	1·23

A larger number of bacteria were present than in fresh meat, chiefly consisting of a motile bacillus, not putrefactive, very resistant, and facultatively aerobic.

From this and other experiments it appears that carbonic acid, though generally effective for mineral waters, will not of itself prevent changes in milk or meat.

The vapor of carbon disulphide was proposed in 1878 for preserving meat.

Hydrogen Peroxide.—Paul Bert and Reynard (Berl. Ber., xv, 1585), speak very highly of this substance as practically one of the few disinfectants which have no effect on digestion and yet prevent the interfering action of organisms. They state that all fermentations caused by bacteria are at once stopped by the peroxide, while no effect is produced on the digestive enzymes, dissolved fibrin, albumin, casein, fats, sugar, or starch. The bactericidal influence of light is attributed to the formation of hydrogen peroxide, and experiments have shown that a strength of about 1 in 1,000 is required for efficiency. M. Touchard has recently reinvestigated its action on several bacteria and fungi, and considers it one of the most useful of germicidal agents (Bull. Gén. de Thérap, March, 1899).

Injection with various fluids has been often tried. Morgan in 1857, before this society, explained his process for injecting a salt and niter solution through the vessels of recently killed animals to wash out the blood, but the method was not always successful in preventing putrefaction. M. Gannel even injected aluminium chloride ; this deleterious salt was intended to be removed before use by soaking for twenty-four hours in water. It is well known that meat shows a tendency to first become tainted "near the bone" or at the joints. Consequently a practice has arisen of injecting a preservative solution, usually boric acid, into the acetabulum and other joint cavities to wash out serous accumulations and leave a small quantity of the antiseptic. The method seems successful, and has the advantage of introducing a minimum of the chemical substance.

* Journ. of Pathol. and Bact, 1893, i., 468.

ACIDS.

Since the great majority of bacteria grow best in neutral or alkaline solutions, nearly all acids have more or less inhibitive power on putrefaction. Meat has been preserved by immersing repeatedly in dilute hydrochloric acid and drying. When required for use it was dipped in dilute sodium carbonate ; only salt was then left. Vinegar and acetic acid have already been referred to.

A "butter preservative," imported into the United States, was diluted phosphoric acid (1887).

Sulphur dioxide, or sulphurous acid, is one of the oldest of the antiseptics, and as produced by burning sulphur was known to all the ancient nations. Wine casks and skins were sulphured.

At Augsburg, in 1400, a special law was enacted, forbidding the sulphuring of casks. In the records of the common council of London, in 1635, certain wines were pronounced unwholesome, and condemned to be destroyed, because, among other things, they contained "some quantities of sulphur."

Sulphurous acid and the bisulphites absorb oxygen, therefore, prevent aerobic organisms from acting, and so retard souring and many changes. They are much used by brewers for casks, and in finings, by makers of lime-juice, liquors and cordials, bottled beers, bottled fruits, sometimes by vinegar makers, and powdered bisulphites by butchers.

The poisonous bisulphite of zinc has been patented for preserving meat.

The quantity of sulphurous acid or bisulphites required to kill or inhibit organisms has been very variously stated. The efficiency is considerable against molds and ferments, but when used in effective amounts they are apt to communicate a bad taste. In canned goods they are objectionable, as they dissolve the metals. Sulphites do not seem to have been noticed yet by the departmental committee, although they are probably more commonly used at the present time than any other preservative.

Salicylic acid furnishes an example of the different antiseptic value of closely allied substances. There are three isomeric oxybenzoic acids, $C_6H_4(OH)COOH$, of which the ortho- (salicylic) is twice as powerful an antiseptic as the para-, while the meta-acid has intermediate properties. "Artificial" salicylic acid when imperfectly purified from the creosotic acids, seems to have stronger physiological effects than the "natural" acid from oil of wintergreen, and the objection to its use as a preservative may partly be attributed to this cause.

The sensitiveness of different bacteria to salicylic acid seems to vary, and Vallin, Neubauer, and Béchamp have shown that many bacteria and ferments rapidly acquire a tolerance toward it. This probably accounts for the discrepancies in the statements as to strengths required for killing organisms, such as Jalan de la Croix, 1 in 200 for milk, and more than 1 in 35 for germs in meat juice ; Kuhn, 1 in 200 for germs in albumen solution ; Bucholtz, 1 in 362 ; Ratimoff, 1 in 400. Of sodium salicylate, the quantity is stated as 1 in 100 by Miquel, and 1 in 161 by Bucholtz. In other cases, salicylic acid was found to be "without effect on bacteria, even in quite large quantities" (Journal Chem. Soc., xxxiv, 258 ; Pharm. Journal, 1881, p. 765), while Dragendorff states that "sodium salicylate has a stronger action on certain bacteria than phenol, quinine, boric acid, or alcohol, and has about one-third the power of salicylic acid."

Many additions are made to increase the solubility of salicylic acid, which is only 1 in 500 of cold water ; of these, borax and glycerine are the most frequent. Several beer preservatives have consisted of sodium salicylate and borax dissolved in glycerine ; willow bark, salicin, and poisonous bitters have also been found (Battershall).

In many countries the use of salicylic acid is prohibited. In England it has been largely used in sirups, temperance drinks, and "British wines."

Benzoic acid dissolves in 220 parts of cold water. Researches in 1873 and following years attributed to it a greater antiseptic power than phenol or salicylic acid.* Salkowski† showed that benzoic acid, in a dose smaller than salicylic, prevented for a long time the putrefaction of meat juices and the development of bacteria. Bucholtz found that 1 in 1,000 stopped the growth of micro-organisms.‡ Jalan de la Croix ‖ proved that the least quantity which would prevent bacterial growth from being inoculated into a fresh liquid (beef tea) was 1 in 2,800. To kill bacteria he required 1 in 400, to sterilize spores 1 in 50. Vallin's work (Désinfectants, p. 202) practically agrees with this estimate. As regards non-organized ferments ("enzymes") Wernitz§ states that pepsin is "neutralized" by 1 in 200, and others by 1 in 300, of benzoic acid or benzoate of soda. Graham Brown¶ placed sodium benzoate higher as a bactericide than quinine hydrochloride or sodium salicylate. The physiological effects are said to be much less than those of salicylates. In fact benzoic acid exists in the urine of man and hippuric (glycocine-benzoic) in that of the herbivora.

Benzoic acid prevents fats from becoming rancid, as in Adeps benzoatus (benzoated lard), B.P. The benzoates have less taste and odor than the free acid, and in the small quantity that is required they would seem to be an unobjectionable preservative. Their use for preserving milk and provisions was suggested in England in 1886.** Where the taste and odor do not interfere a saturated solution of benzoic acid in water delays the putrefaction of animal matters much more effectively than salicylic. It has less effect on vegetable infusions. Added to milk a very small quantity prevents coagulation.††

The introduction of the sulphonic group usually increases the solubility of organic compounds, diminishes the odor and actions on animals, while rather augmenting the antiseptic power ; hence many bodies of this class are used as preservatives, such as phenol-sulphonic acid, benzosulphonic (as "sodium sulpho-

* Med. Times and Gaz., ii, 488 ; Pharm. Journ., 1875, p. 307.

† Antisept. Wirkung d. Salicyl. u. Benzoesaure, Berl. Klin. Wochenschr., 1875, p. 22.

‡ Archiv. f. Exp. Pathol., 1875, vol. iv.

‖ Ibid, 1881, xiii, 175.

§ Dorpat Essay, 1880.

¶ Kleb's Archiv., viii, 140.

** Chemical News, 1886, i, 130.

†† Horn, Zeits. f. Chem. Ind., 1888, ii, 220.

benzoate"), "saccharin" (benzoyl-sulphonic imide), and others.

Fluorides.—The antiseptic properties of these salts are considerable. Many years ago, W. Thompson advocated the use of sodium silicofluoride, under the name of "Salufer." Dr. Effront, in 1892, found that hydrofluoric acid and the alkaline fluorides protected wort from lactic and butyric fermentation, and actually increased the diastatic power of malt. Recently attention has again been directed to their use, and in comparative experiments I have satisfied myself that they are equal to the corresponding benzoates in molecular preservative property.

Glycerine has been much used, but mainly as an adjunct to, or solvent of, other preservatives, and for disguising taste. A. Schmidt * states that glycerine, alum, and sodium bicarbonate are added to beer, and that "beer poor in extractive and alcoholic constituents is liable to become sour, a defect which is remedied by the use of alkalies and chalk, the resulting disagreeable taste being disguised by means of glycerine."

On account of its sweet taste, non-susceptibility to alcoholic fermentation, and slight antiseptic property, glycerine has been largely used in wines, temperance drinks, and beef-juice extracts. It is, however, only a preservative in strong solutions (22·5 per cent. Michél); weaker ones undergo a butyric fermentation.

Hams and dried fish have been soaked in 20 per cent. glycerine for preserving, but its hygroscopic property has militated against its use in this direction.

Molecular Proportions.—It is evident that in contrasting a series of salts of the same acid, a solution containing in the same volume an equal number of molecules of the salt must include in each case an equal weight of the acid groups; any difference in the behavior will then be due to the variation in the base.

Similarly by taking molecular proportions of the different salts of one metal, the influence of the molecular weight of the different acid groupings upon the retardation in the development of the putrefactive organisms may be traced.

In some experiments in this direction, not yet published, I have determined the retardation in the souring of milk by molecular proportions of different salts, and find that the alkaline metals, potassium, sodium, and lithium, show great resemblance, while the equivalent of ammonium, probably owing to its decomposition, distinctly promotes the production of acid.

With regard to the acid radical, chlorides are conducive to souring—common salt especially not only not hindering, but actually often accelerating the decomposition. Nitrates, on the other hand, have an inhibitive effect. Benzoates and fluorides have a decidedly preservative action, which for short times is greater in the former, and is specially marked in benzoic acid. Probably owing to their decomposition, the effect of benzoates wears off in longer times, whereas that of fluorides remains fairly permanent.

Boric Acid and Borates.—The knowledge of the preservative action of these compounds is, as we have seen, quite of modern date. The discoverer, Ghan, introduced a mixture of boric acid and alum as "aseptine" for preserving food. It was stated that boric acid alone caused the formation in a few months of a blackish crust, but that alum prevented this; the same end is now attained by the addition of borax. Aseptine had no action on molds. In August, 1872, M. Dumas introduced boric acid and borax to the French Institute as preservatives for food. The sparing solubility of boric acid (about 4 per cent.), and its tendency to crystallize out, were obviated by combining it with many substances, such as tartaric and other acids. In 1882, F. Barff read a paper before this society on his "Boroglyceride," a very soluble ester of glycerine and boric acid, made by heating the ingredients together. Le Bon † recommended calcium and sodium boroglycerates. A great variety of boric mixtures have since been introduced under different names, and are very largely used at the present time, especially for the preservation of milk, cream and butter.

Boric acid appears to be widely distributed in small quantities in nature. The following are recorded instances:—

Hotter (Year Book of Pharmacy, 1891, 107): in most fruits.

Gassend (Ann. Agron., xvii, 352): grapes, apples, tomatoes, radishes, lettuce, and occasionally in pears.

Passerini (Staz. Sper. Agrar., xx, 471, and xxi, 565): in the stems of tomatoes.

J. Brand (Zeits. f. d. ges. Braw., 1892, xv, 427): occurs normally in beer, and emanates from the hops, in every variety. 100 cc. of beer, or 5 grammes of hops, suffice for its detection.

Kayser (Chem. Zeit., 1890): carrots, beet sugar, Californian wines, etc., and often introduced into the glaze of enameled vessels.

Georges (J. de Pharm., 6, iii, 346) points out that boric acid is present in purified caustic potash and soda.

Formaldehyde.—Its antiseptic properties were discovered by Loew and Fischer in 1886, and were further examined and turned to practical account by Trillat in 1888. A large number of observers have since investigated it, and have agreed that it is one of the most powerful of all antiseptics. In 1894, with Dr. Slater, I found that 1 in 20,000 inhibited the growth of several typical bacteria, while 1 in 2,500 was required to prevent the growth of yeast, suggesting the use of formaldehyde for arresting secondary fermentations in alcoholic liquids.‡ It has also been applied successfully, either in solution or vapor, to milk, meat and other articles of food.

Formaldehyde may even exist naturally in food, as Pollacci has separated it by distillation from leaves which have been exposed to light and macerated in water.‖ In commerce it is met with as a 40 per cent. solution called "Formalin."

Last May, Mr. A. G. R. Foulerton and myself, in a paper published in Public Health, expressed our opinions (1) as to the quantities of boric acid and formaldehyde necessary for preserving milk, and (2) the possibility of such quantities having injurious effects. Since then, Mr. Foulerton has further dealt with the second branch of the subject, and his conclusions, in which I concur, are given in The Lancet of November 25 (page 1427), and December 9 (page 1577), 1899.

A good deal of recent criticism has assumed the possibility of comparatively large doses being present in food supply. But milk is practically the only article of food which is consumed in sufficiently large quantities so as to cause the amount of preservative to possibly assume toxic proportions. In the paper referred to we stated that 1 part in 2,000 of boric acid mixture (4 grains to the pint) and 1 in 50,000 of formaldehyde were quantities of preservatives sufficient for keeping milk sweet for a period of 24 hours even in warm weather.

These quantities cause some slight retardation when the examination is made before the digestion is completed, that is, after equal times, but a little longer time sufficed to ensure the complete digestion of the preserved food. It is also important to recollect that both preservatives have practically no effect upon the digestion of casein, and, therefore, in a milk diet, their effect is less marked than when the preservatives are used with meat or starchy foods. The following experiments show that the influence of these preservatives in the above quantities is comparable to that of condiments, or alcohol or tea, upon starch digestion:

Breadcrumb, 5 grm., with 50 c.c. water, exposed to Action of Ferment for Half an Hour.

	Zymine. Maltose produced.		Saliva. Maltose produced.	
1. Nothing added	0·5395	= 100	0·707	= 100
2. Formic aldehyde, 1 in 50,000	0·477	= 88·5	0·672	= 95
3. Boric acid, 1 in 2,000	0·423	= 78·5	0·607	= 86
4. Malt vinegar, 2½ c.c.	0·258	= 48	0·1647	= 23
5. Salt, 0·2 gramme	0·52	= 97	0·70	= 99
6. Worcester sauce, 1 c.c.	0·5	= 93	0·57	= 82
7. Alcohol, 5 per cent. (claret and water, 25 c.c. of each	0·47	= 88	0·701	= 99
8. Tea, ½ gramme infused in 50 c.c. of water	0·4901	91	0·650	9[illegible]

In the pancreatic digestion of casein, no difference could be observed in the amount of casein digested with and without formaldehyde, whereas an addition of a small quantity of infused tea, claret, or Worcester sauce to the milk reduced the amount of digested casein to a small but noticeable extent. The conclusion is that the small amount of preservative has actually less effect than these ordinary additions to food.

Other investigators have also found that many ordinary food substances have an effect on digestion quite comparable with that of these small quantities of preservatives. Thus E. Laborde *—digested coagulated egg-albumen with pepsin or trypsin at 40° C., for three to four hours alone, and in presence of various bodies allied to the alcohols. He finds that while some of the substances present in beverages, such as isobutyl alcohol and glycerine, are distinctly favorable to both peptic and pancreatic digestion, ethyl alcohol, lactic and tartaric acids retard them. According to this author, dextrose assists pancreatic, but delays peptic, digestion.

At the present time these quantities are frequently exceeded, and I think most of us hope that the departmental committee will make it compulsory for the presence of any preservative in milk to be declared at the time of purchase, as it is now agreed that in special cases, such as of invalids, the consumer should be able to obtain a milk free from preservative, and in all cases he should be aware of its presence. In such declared milk any amount of boric acid or formaldehyde in excess of the limits mentioned above would be foreign additions to such declared milk, which no vendor could put forward as necessary preservatives.

Recorded cases of the toxic effect of boric acid showed that fifteen grains a day may, in a fortnight, produce skin eruption in susceptible individuals (adults), so that this quantity must be regarded as the maximum amount per day which may be safely taken by an adult. An invalid on milk-diet could possibly take as much as twelve grains per day—that is, in three pints so that the toxic limits would be very nearly reached in such a case; while a child aged six months might take as much as thirty-two ounces of cow's milk per day, or about six grains per day; and this quantity, in relation to the body-weight, approximates to the amount which, in some individuals, has produced injurious effects. Of bacon, 3 pounds to 6 pounds must be consumed daily to give a toxic dose. In cream and butter, the toxic quantity with ½ per cent. preservative amounts to about ½ pound per day.

The advisability of allowing greater amounts of preservatives than those mentioned to be present in "declared" milk is determined by the question whether the larger quantities are neccessary for trade purposes. This point, of course, depends largely what is understood as "sour milk" by the consumer, and this must obviously depend upon the acidity of the milk expressed in terms of lactic acid. In the following table I summarize the results obtained in a series of experiments undertaken to ascertain this point. Quantities of fresh milk containing (1) in 2,000 of boric acid, (2) 1 in 50,000 of formaldehyde, and (3) a control, were kept at the following temperatures: 13° C., 18° C., and 24° C. (as representing approximately winter, medium, and summer temperatures); and the amount of acidity in terms of lactic acid determined after different intervals of time. The milk used had an acidity corresponding to 0·18 per cent. of lactic acid.

From these results it will be noticed that at the lowest temperature—viz., 13° C.—even after 39 hours there is no increase in the acidity of the milk containing boric acid and formaldehyde, the actual titration recording a slightly lower amount of lactic acid. (The possible experimental error in these figures amount to + 0·007 per cent. of lactic acid.) In these two milks at 18° C. there is no appreciable rise in the acidity till after 23 hours' incubation, while the unpreserved milk shows a gain of about 15 per cent. In considering the result at 24° C., the question arises as to what maximum acidity can be allowed to milk without it being pronounced sour. In some milk the rate of production of acidity is much greater than this, as it obviously depends on the number and kind of organism present.

Thorner † has investigated the acidity requisite to

Table I.

	Per cent. lactic acid. 13° C. (55·4° F.)	18° C. (64° F.)	24° C. (75·2° F.)
Fifteen hours:—			
Blank	0·182	0·202	0·232
Boric acid	0·180	0·180	0·216
Formaldehyde	0·182	0·180	0·194
Twenty hours:—			
Blank	0·184	0·205	0·245
Boric acid	0·180	0·198	0·220
Formaldehyde	0·178	0·179	0·198
Twenty-three hours:—			
Blank	0·184	0·210	0·281
Boric acid	0·180	0·180	0·241
Formaldehyde	0·178	0·181	0·223
Thirty-nine hours:—			
Blank	0·191	0·392	0·799
Boric acid	0·178	0·259	0·648
Formaldehyde	0·173	0·209	0·590

coagulate milk on warming as corresponding to 0.207 per cent. of lactic acid, but I have found (Lancet, January 27, 1900) the coagulating point somewhat higher than this, as the coagulation is not very marked even when the acidity is 0·23 per cent., and I believe that when the acidity exceeds 0·25 per cent. of latic acid the milk would be considered sour and unfit for sale. Taking this as the maximum acidity allowable, it will be seen that in all cases the milk has been kept sweet by the 1 in 2,000 of boric acid, and 1 in 50,000 of formaldehyde, for over 23 hours. Even if Thorner's limit of 0·207 per cent. of lactic acid be taken it will be seen that the quantity of boric acid and formaldehyde suggested are ample for keeping a milk sweet for 23 hours at 18° C. But the quantity of boric acid is insufficient for keeping it sweet for a longer period than 15 hours, and of formaldehyde for a longer period than twenty hours, when the temperature is as high as 24° C. The initial acidity of milk varies very considerably, and may be as high as 0·1 per cent., so that, taking it generally, the work required of the preservative is to arrest the production of one-tenth per cent. of acidity calculated as lactic acid in the milk during the time which must necessarily elapse between the time of milking and the time of consumption.

Another important point to bear in mind is that a preservative is obviously more efficient if added to the milk at the time of milking so that the development of the organism present in the milk is retarded from the very commencement. The legitimate use of milk preservatives should be restricted to the farmer or cowkeeper and removed from the middleman, or vendor, or consumer. It is urged by some that the consumer could preserve his milk if he thought it was necessary, but without entering into a discussion of Dr. M. K. Robinson's case, and dismissing for the moment Dr. O. Liebreich's reply to it, which, in my opinion, seems clearly to establish that the poisoning was not due to boric acid, such a method of dealing with the problem would open the way to future cases similar to that of Dr. Robinson in which excessive doses of preservatives might be taken by succeptible individuals.

In the case of butter the loss of flavor and the beginning of rancidity are very carefully gaged by experts, so that points or marks of value are assigned to butters which gives their commercial value. In the report for the New Zealand Department of Agriculture for 1898, Mr. Sorensen shows that butter containing 3 per cent. of salt and ½ per cent. of boric acid and subjected to cold storage yields on keeping a butter having the greatest number of points, 37 out of 45, while butters with 1 per cent. of boric acid and only 2 or 3 per cent. of salt gave an inferior result, and those containing either more or less salt without boric acid had lost still more flavor. These results show that in this particular case it is to the interest of the trader to keep the boric acid low, as from the commercial point of view the butter with ½ per cent. of boric acid has a better flavor and will fetch a better price than that containing 1 per cent.

I wish also to refer to the value of feeding experiments. Those published by Mr. Foulerton and myself with milk containing formaldehyde proved that adult animals, although their body weight was far less than that of man, could consume large quantities of milk with moderate amounts of preservatives without apparent injurious effect.

It has been pointed out by Dr. H. E. Annett and others that cats used in these experiments were three months old, but we did not mention that we had previously attempted to feed kittens three weeks old similar to those used by Dr. Annett, without success, as we found that kittens of this age, when taken directly from their mother, were not capable of assimilating undiluted and unpreserved cow's milk, and six kittens thus fed died under our hands. I attribute this partly to the fact that cow's milk is an unfit food for young kittens, as it is well known that the characteristic of cat's milk is that it contains 6 per cent. of albumen, a constituent which is only present in cow's milk to the extent of about ½ per cent., so that such food is as unsuitable for young kittens as undiluted cow's milk is for infants. It will be noticed in Dr. Annett's experiments* that in these young kittens the results were very irregular, and that whereas the normal rate of increase per week should be from 30 to 40 grammes, or roughly 10 per cent. of the body weight, in kittens receiving untreated milk, in some cases he actually obtained decrease in weight, and in others only an increase of two or three grammes. The heavier and older the kittens the more reliable are the results. It is singular that Dr. Annett, with the smaller quantity of preservative (40 grains), obtained two deaths out of five in the third week, whereas with the larger quantity (80 grains), all the animals survived. Similar results were obtained by him with the milk containing

* Archiv. der Pharm., 1885, vii, 392.

† Comptes rendus, xcv, 145.

‡ Lancet, April 21, 1894.

‖ Chem. Centralblatt, 1899, ii, 881.

* Journ. de Pharm., 1899, vi, 10, 484.

† Chemische Zeitschrift, 1901, p. 1,108.

* Lancet.

formaldehyde, as he obtained three deaths with the weaker solution, none with the formaldehyde of 1 in 25,000, and two with the stronger solution. Before these experiments of Dr. Annett were published I had carried out a few feeding experiments with kittens about five weeks old, at which age they can take cow's milk freely, but I restricted the quantity to about 70 cubic centimeters per animal per day and used the preservative in the proportions already advocated, so that each kitten received about half a grain of boric acid per day. The results are summarized as follows:

TABLE II.

	Average weight in grammes of animal fed on—			
	Milk.	Milk + formaldehyde.	Milk + boric acid. (1)	(2)
1st week ..	517	591	595	630
2nd week ..	537	657	646	664
3rd week ..	610	674	684	744*
Percentage increase in weight on first week.				
2nd week ..	3·87	11·1	8·6	5·4
3rd week ..	18·00	14·1	15·0	18·1

* In the third week this kitten was fed on formalised milk instead of borated milk.

Making allowance for the difference between different animals and the irregularities always noticed in animal experiments, the natural increase cannot be said to be interferred with. As pointed out by Dr. Liebreich we have in Dr. Annett's experiments no information given us as to the quantity of milk supplied to the kittens, and it is quite possible that they received a much larger quantity of preservative than the above. As a kitten weighs approximately one pound and I gave mine half a grain of boric acid per day, it would follow that a child six months old, weighing twelve pounds, could take six grains of boric acid a day, or, say, a pint and a half of preserved milk. If any value, therefore, is to be attached to anjual experiments, the relation of body weight to the amount of preservative exhibited must be taken into account. Of course, this relation is recognized in the Pharmacopœia, but it is well known that the usual allowance for doses for children of some drugs does not obey any definite law. In the Pharmacopœia this quantity of six grains of boric acid per day for a child six months old would be about eight times the medicinal dose. I am, therefore, inclined to agree with Mr. Foulerton that experiments on animals have, after all, but a very slight bearing upon the problem under investigation. As Dr. Liebreich points out, even regarding Dr. Annett's experiments in their most favorable light, they by no means prove that boric acid and formaldehyde are poisonous for young children, even in quantities largely in excess of those which would be possible in a milk diet when the preservatives were regulated in the way suggested.

WHY IS WATER BLUE?

THIS question may seem to some readers absurd, yet its answer is still, to some extent, in doubt. The received opinion has been that water is not of a blue color in itself, but appears so on account of fine suspended dust that catches and reflects the blue rays just as the particles of smoke do when it is very fine and thin. On the other hand, the experiments of Prof. Spring, the Belgian physicist, seem to indicate that the water itself has really an azure tint. Says The American Chemical Journal, in a discussion of Spring's work:

"Earlier experiments of Spring led him to the conclusion that water itself is blue, and that the fine particles which it holds in suspension, while contributing very much to its illumination, exert no appreciable influence on the intensity of the blue color. Soret had previously, in 1869, expressed the same opinion. As neither the work of Soret nor that of Spring appears to have convinced every one, Spring has again taken up the subject. With the object of determining experimentally the optical properties of the particles in clear waters, parallel rays from a powerful electric light were passed through (1) distilled water, (2) the drinking water of Liège, and (3) rain water that had been allowed to stand. In all cases the presence of particles became apparent, the clearest being the drinking water. There was no evidence of a blue water."

Further experiment, however, furnished the desired evidence. Light of different colors was allowed to pass through the water, with the following results:

"These experiments show that the particles, to which clear water, distilled or natural, owes its illumination, have the power to reflect the red, the yellow and the green waves, and that they cannot, therefore, be the cause of the blue color of water. Reflecting with equal facility waves of all lengths, they return the sunlight to us without chromatic change. The author concludes that water is blue of itself, and that the particles which it holds in suspension are the principal cause of its illumination. According to their nature, they determine also the modification of the color of the water, and produce greenish tones when they do not destroy all the natural color."

Request for Dried Apples and Salmon in France.—Consul Brittain, of Nantes, under date of February 27, 1900, writes:

M. Charles Beuchet, of No. 46 rue Gigant, Nantes, is anxious to obtain the name of some responsible exporter who will sell him dried apples, better known as chops. These apples are cut in thin slices—seeds, skins, and stems—then dried and packed in old sugar barrels for shipment. They are used in making a cheap drink by the poorer class among the French. The same gentleman wishes to obtain the name of American exporters of other dried fruits, and also the names of reliable salmon packers of the Pacific coast. He has been purchasing salmon from packers in Canada. Persons wishing to increase their foreign market in the above lines should open correspondence with him at once.

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